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It would be interesting to know what proportion of alternating apparatus as at present manufactured is polyphase. When this variety of apparatus was introduced in the market it was not every station superintendent who was familiar with it, and to a certain degree they were afraid of it, but so far as the larger scale of plants is concerned there is almost no installation of single-phase apparatus today. Much of the early single-phase machinery was altered into polyphase types as soon as the advantages of the latter system became generally evident. A very interesting census could be taken now of existing machines to discover how much single-phase apparatus is left. Practically no large new installations are going in on a single-phase basis.

SOME POWER-TRANSMISSION LIMITATIONS.

Ever since the development of electric power-transmission methods began the distances covered, the amounts of power transmitted and the tensions employed have increased. The public in general has cherished the opinion that there is really no limit to power-transmission distance, and some color of justification is given to this belief by the superb work lately done on the western coast.

There are, however, some limits to power transmission by electricity which are not very definitely understood as yet, and of which accurate knowledge would be of considerable engineering importance.

Perhaps the first of these is the breakdown strength of insulating materials of various kinds and of the air itself. It has been lately considered that about sixty thousand volts is the limit imposed by the resisting properties of the air, as above this voltage the air seems to conduct reasonably well and leakage occurs across the line. It would be highly desirable, were it possible, to have accurate knowledge on this subject, and especially to discover whether or not the condition of the surface of the conducting wires and their diameter does not play a considerable part in the question of air leakage and the formation of streamers.

From the present knowledge of the subject it appears that insulators of porcelain are strong enough to withstand any electrical strain which can safely be borne by the atmosphere. The matter of cable insulation for very high voltages, however, has perhaps not received the attention that it deserves by investigators, and is worthy of elaborate and careful study. It would be interesting to know what is the highest voltage at present worked in cables and the conditions under which it operates. It is certain that this present limit is nowhere nearly that which is believed to be set by the breakdown strength of the air, although insulating materials such as are used in cable construction have a much higher disruptive strength than the air.

Putting aside possible limits to the length of power-transmission lines due to the wave-length of the transmitted current, it seems as if the present cost of conducting metals and insulation imposes a fairly definite limit to length under given conditions of transmission. It is evident that an important factor, other things being equal, is the amount of power to be transmitted; or, more properly speaking, the amount of power that can be sold and the price that can be obtained for it at the receiving end of the line. The matter is one of commercial consideration entirely, and probably each case would have to be judged for itself, as no working law could be made taking in all the diverse elements which control the problem. In most places transmission lines are subject to the competition of the coal-carrying railway. Unless the price of fuel is materially advanced, or that of conducting copper or aluminum materially diminished, it is probable that in the eastern states, at any rate, the transmission distance limit will not be large. But, again, the limit is largely controlled by the amount of power to be transmitted; for example, it is capable of demonstration that power might be transmitted to New York from a distance of one hundred miles and sold here profitably if it came in units of about two hundred thousand horse-power; whereas, if the amount was smaller, it is not likely that it could compete satisfactorily with power generated by coal in the city itself.

For the present, at least, it is likely that conservative engineering will confine itself in the eastern states to reasonable transmission distances, where an examination of the physical and financial conditions of the problem would indicate a profit upon the necessary outlay. The principal limit to-day to the distance of power transmis-

sion and to its effectiveness is the price of conducting material. As it is generally believed that the price of copper is destined to remain high, we must probably look to aluminum as a substitute. Doubtless the production of this metal will be larely increased after the expiration of patents controlling methods now in use, and we may expect to see it appear on the market at a considerable reduction from present quotations.

FIRE-ALARM TELEGRAPHS.

The evolution of means for fighting fire in cities has been comparatively rapid, and within the narrow limits of one generation has passed from the stage of the amateur volunteer fire company, depending on cries of "Fire" for information and alarm, to the disciplined and elaborately equipped fire departments of today, with their complete electrical systems for fire-alarm purposes.

The value of any city fire department depends upon the reliability, accuracy and general perfection of the electric fire-alarm signal system which is operated in conjunction with it. If the electric alarm should be disabled, then the best fire department service conceivable would be so severely handicapped that it is probable that even small and easily handled fires would grow to dangerous proportions before help could arrive on the scene. Conversely, even a meagre and indifferently equipped department could do excellent work were it to receive instantaneous and early notice of the appearance of fire. For these reasons nothing is of more vital importance to the preservation of property from conflagration than the maintenance of fire-alarm signal systems at the very highest possible point of efficiency at all times.

It is seriously to be questioned if this is always done. Almost universally the fire-alarm signal system of a city is municipally owned and is under the control either of the fire department itself or of a special bureau. These systems suffer from the same causes which have worked so often disastrously in the case of municipal electric light, gas and water systems. Sooner or later the element of politics is apt to enter. Unfit men are chosen for political reasons rather than for their ability, and both the physical condition of the system and the character of its operation deteriorate.

When it is considered that at all times the safety of life and property depends upon the absolutely correct operation of these signals it is easy to understand how important they are to the general welfare of a city and how vital this element of the city's equipment is. The art of fire-alarm signaling has developed to a point of high perfection, and systems may now be installed which, under proper care and supervision, may be depended upon as absolutely as any other agency of human construction. But, like all other electrical apparatus, fire-alarm systems require careful, competent, vigilant and perpetual supervision. These, unfortunately, they do not always obtain. At a fire which occurred in New York city on October 20 it is stated that an alarm turned in from a street box resulted in a confused signal that sent the fire department to a point several miles distant from the scene of the conflagration. By the time this mistake was rectified much damage had been done. In many instances of late there has been a suspicion, to say the least, that the fire-alarm signal system of the Borough of Manhattan, New York city, is not entirely reliable. The exact truth of this condition can not, naturally, be discovered without investigation and report, nor is it even certain that it exists, but it is certain that a suspicion of its reliability is extant. The fire-signal service of a great city should be absolutely above suspicion. If such suspicions are justified by the facts nothing should be more quickly done than the repair and rehabilitation of the fire-alarm lines in question. For its own justification an official examination of the condition of the circuits should be h ld by the responsible department. This, at least, would set at rest the fear that is felt in some quarters that all is not as it should be in the particular case referred to.

No less than forty-six new electric railways are now under construction in the single state of Ohio, and since last March eight hundred and fifty-three new lines have been started in the United States and its possessions. This is more railway building in eight months than was done in the first eight years of the industry—the strongest commentary upon the importance and commercial success of electric traction.

THE YALE BICENTENNIAL.

The Bicentennial Celebration which took place at Yale University during the first four days of the week beginning October 20 was a noteworthy event in the life of that great institution of learning. What can spring from small beginnings is aptly illustrated in the history of Yale.

About two hundred years ago a number of clergymen assembled in the house of the Rev. Samuel Russell, at Branford, Ct., and donated a few volumes of books for the establishment of a place of learning and as the foundation-stone of a college in Connecticut. In this simple and obscure way were laid the foundations of the present university. For several years instruction was imparted, mostly by clergymen, to the few students who attended.

During the early years of its existence the college was located in several different Connecticut towns, but with its removal to New Haven the growth of the institution has been steady, until at present the enrolment has reached nearly three thousand students, working in all departments of human thought and attainment. These departments are presided over by a corps of several hundred distinguished men selected for their worth and attainments in their various departments of knowledge.

The celebration, which has been recently held, was remarkable in many respects. Distinguished men engaged in many diverse pursuits from all parts of the world were gathered together to do honor to this noble and venerable foundation and to receive honors from her hands. Their great and never-failing interest in their alma mater was shown by the number of graduates present, among whom men from all walks of life were noticeable. The kindly interest in the welfare of the university by the citizens of New Haven was evidenced by their large attendance at all the functions where it was possible to admit them.

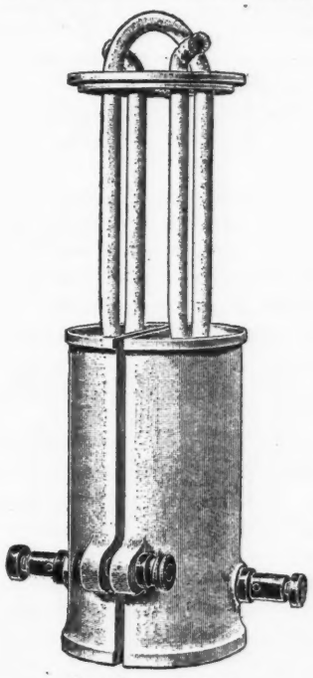
We can view the progress of the past two centuries only as an index of what is to come in the future, and congratulate the university not only upon the record of its useful past but upon the hope of its vitalizing future.

Science Brevities

On the Color of Ions—M. G. Vaillant describes in an article in the *Comptes Rendus* which is reviewed in the *Electrochemist and Metallurgist,* a few experiments made with the spectrophotometric apparatus of Gray upon the permanganates of potassium, zinc and barium, with a view to confirming the following propositions: 1. In a completely dissociated solution containing only one colored ion the color is independent of the nature of the other ion. 2. If, on the contrary, the ionization is not complete, the coloration varies with the concentration and with the nature of the colorless ion. 3. The coloration of a solution of whatever possible concentration can be, as a rule, connected with the value of its degree of concentration by a formula containing two, and only two, constants, which relatively characterize the complete molecule and the dissociated molecule.

Orlyte — A New Material — Professor Orlowsky has undertaken a series of researches upon the best way to reduce the excessive hygroscopic properties of carbide of calcium, the results of which have been the discovery of what is practically a new material, "orlyte." An article describing his work has been published in the *Journal d'Electrolyse* and reviewed in a British journal. Neither a vacuum, nor high pressure, nor high temperatures being of any avail to impregnate calcium carbide, Professor Orlowsky thought of dropping the pasty mass of carbide, as it issues from the furnace, into a mixture of natural tar and mazout or astatki, the proportions and application of which are protected by a patent. The first experiments on a large scale were made at the works of Roessler und Halske, Frankfort-on-Main, and later on developed in France by the Compagnie Générale d'Electrochimie. The operation lasts about a minute, during which the carbide absorbs four per cent of impregnating material. The inventor claims for the new product a yield of 300 to 310 litres of acetylene per kilogramme and a lighter and more perfect flame, the improvement being ascribed to the evaporation of hydrocarbons during the formation of the gas. Orlyte is not hygroscopic, the greasy material it contains being unaffected by moisture; but that does not prevent the complete decomposition of the carbide by water when this liquid is present in sufficiently large quantities; moreover, the greasy stuff acts as a binding material between the particles of carbide and prevents granulation when idle, as well as the formation of a scum on the gas producers during reaction. The author concludes with various calculations tending to prove that, taking the price of carbide at 300 francs per metric ton, and orlyte to yield 300 cubic metres of acetylene per ton, the use of the latter would result in a saving of 68 francs per ton of material for the same quantity of gas.

Disc Interrupter for Alternate Currents—E. Ruhmer reports some further improvements in the liquid interrupter with exchangeable perforated plates in an article in the *Physikalische Zeitschrift* which is digested in the London *Electrician.* The electrodes are introduced through the



DISC INTERRUPTER.

sides, thus obviating gliding sparks which might lead to explosions. By making one electrode of lead and the other of aluminum the author has succeeded in producing an apparatus which only interrupts the alternating current in one direction. This is of special utility in Rœntgen-ray work. The life of an aluminum electrode is about 500 hours.

Extinction of Lithium and Alkaline Chlorides by Electrolysis—H. Becker describes the electrolysis of crude fused lithium chloride containing chlorides of the alkalies and alkaline earths, but not magnesium, in an electrolyzer of special form, in an article in *Industrie Chimique,* which is abstracted in *Lightning.* The anode is cylindrical, the slightly conical cathode is placed within and is surmounted by a kind of funnel in which the metal, being lighter than the liquid, collects, and from which it is tapped at intervals. The same journal describes Moritz-Egken and Leroy's process for the electrolysis of alkaline chlorides. It is characterized by the use of terminals very close together, so as to act on thin layers of liquid circulating very rapidly. The yield is said to be 320 grammes of caustic soda per kilowatt-hour.

Electrochemical Behavior of Acetylene—A paper by Mr. Alfred Coehn on this subject is abstracted in the current number of the *Journal* of the Chemical Society, as follows: "The discharge potential of oxygen from a solution of potassium hydroxide is depressed, when acetylene is passed through the solution, from about 1.7 to 1.2 volts. The chemical reaction, of which this depression is an indication, is the oxidation of acetylene to formic acid, which takes place quantitatively when the electro-motive force employed lies between the above limits. In solutions of sulphuric acid, the presence of acetylene diminishes the anodic polarization by about 0.19 volt. The chemical change in this case is the oxidation of acetaldehyde (formed by the action of acetylene on sulphuric acid) to acetic acid. The current efficiency is 100 per cent when the electro-motive force used is less than that required for the liberation of oxygen. In acid solutions acetylene does not act as a depolarizer for the halogens except in the presence of a carrier, such as phosphorous tribromide, when a considerable depolarization occurs."

Space Telegraphy—Skunkichi Kimura, a Japanese naval electrician, has made some valuable researches on the influence of the earth on wireless signaling, which have been published in the *Physikalische Zeitschrift,* and reviewed in a British contemporary. This influence can not be determined by means of the Marconi apparatus, since neither the coherer itself nor its tapping mechanism works uniformly. The author therefore employed his "sound receiver," which indicates all variations of the current by variations of the intensity, sharpness or duration of the tone. He used five different earth contacts for the mast-wire, comprising plates, cylinders and wires of various materials and dimensions. The best results were obtained with a tin cylinder put in a ground saturated with sea-water. The author believes that the earth connection works by its capacity rather than its conductivity, and a large earthing plate is, therefore, advantageous. Signals over 50 miles were obtained with an earthing device consisting of three oil cans placed on grass. He points out that the induced electro-motive force can not be the sole cause of the decrease of resistance in the coherer, and that a node of potential can not exist at the other end. The problem of "tuning" must in any case take into account the capacity of the earthing arrangement.

THE THEORY OF ALTERNATING DYNAMO ELECTRIC MECHANISMS—XLVII.

BY W. ELWELL GOLDSBOROUGH.

The mesh connected system of circuits being the exact equivalent of the star connected system of circuits, the former can be made to replace the latter in any three-phase system without in any way modifying the line electro-motive forces or the power absorbed in the lines.

In proceeding with the solution of a three-phase, mesh connected system, conditions have to be met which require, in extreme cases, the use of the best judgment and skill in the application

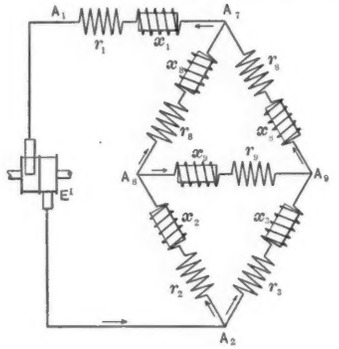


FIG. 119.—ALTERNATING MECHANISMS.

of graphical methods. Suppose, for instance, we attempt the solution of such a system as that shown in Fig. 117, applying thereto the method of supposing each phase of the alternator to operate separately for the development of the initial phase diagrams. If, then, phase E^I is alone considered to be active, Fig. 117 reduces to the arrangement shown in Fig. 119. Here, since E^{II} and E^{III} are absent, the terminals A_2 and A_3 of Fig. 117 have been merged into the single terminal A_2 of Fig. 119.

Fig. 119 presents an arrangement of circuits very familiar to every student of electrical engineering. It is the diagram, in fact, of the Wheatstone bridge. However, since E^I represents an alternating electro-motive force, the solution of the system is far more complicated than is a problem of similar character where a direct electro-motive force is used, since, in the consideration of each of the circuits, we have to take into account the effects of inductance in addition to those of resistance. Under these circumstances, a graphical solution is only possible by the application of much patience in adjusting the vector lengths until a balance between the forces appearing in the system is obtained.

Roughly speaking, the small arrows which parallel the several circuits may be taken as indicating the direction of flow of the currents throughout the system at a given instant. Under these circumstances, the current I_1 divides at A_2 into two component currents I_2 and I_3 flowing through the circuits A_3A_8 and A_2A_9. When the current I_3 reaches the terminal point A_8, it also separates into two component currents, I_8 and I_9, flowing respectively in the outside circuit A_8A_7, and the inner cross circuit A_8A_9. The two currents I_9 and I_3 join at A_9 to make a current I_7 of the circuit A_9A_7, and finally, the currents I_8 and I_7 combining to make the initial line current I_1. These conditions are diagrammatically presented in the phase diagram of Fig. 120. Here,

OA^I represents the electro-motive force E^I, which is impressed upon the system;

the vector OB_1 represents the current I_1, which flows through the line circuit $A_7A_1A_2$;

the vector OA_8 is the electro-motive force appearing between the terminals A_2 and A_8;

the vector OA_9, the electro-motive force appearing between the terminals A_2A_9;

the vector A_8A_7, the electro-motive force appearing between the terminals A_8A_7;

the vector A_9A_7, the electro-motive force appearing between the terminals A_9A_7;

the vector A_8A_9, the electro-motive force appearing between the terminals A_8A_9; and, finally,

the vector $A_7A_1^I$, the electro-motive force appearing between the terminals A_7A_1.

The current vector heads shown at B_2, B_3, B_8, B_7, B_9 and B_1, severally indicate the values of the currents apparent in the several circuits in the order in which their electro-motive forces have been pointed out.

In analyzing Fig. 120, there are one or two points to which special attention may be called. At A_9, for instance, we have the vectors A_9B_3 and A_9B_9 combined vectorially to give the current vector A_9B_7. Now, since the current in the circuit A_8A_9 is positive relatively to the current in the circuit A_9A_7, it is negative relatively to the current in the circuit A_8A_7 and, therefore, in obtaining the resultant of the current vectors OB_2 and A_8B_9, for the purpose of ascertaining the phase position of the vector A_8B_8 representing the current in the circuit A_8A_7, the difference of the vectors A_8B_9 and OB_2 must be taken instead of their sum. Accordingly this has been done, as shown in the parallelogram of the current vectors A_8B_2 and A_8B_9. Here A_8B_2 is equal and parallel to OB_2 and A_8B_9 equal to the current in A_8A_9, and their difference is taken by drawing the vector B_9B_2 and making the current vector of the circuit A_8A_7 equal and parallel to it, as shown by the vector A_8B_8.

That the conditions in Fig. 120 are correct can be shown by estimating the amount of power which is expended in each of the circuits, and determining whether or not this power is equal to that developed by the generator. To facilitate the discussion of this point, the data pertaining to Fig. 120 have been collected and tabulated in table 14. From this table we see that the power developed in the circuit A_1A_7 is 20,400 watts, and so

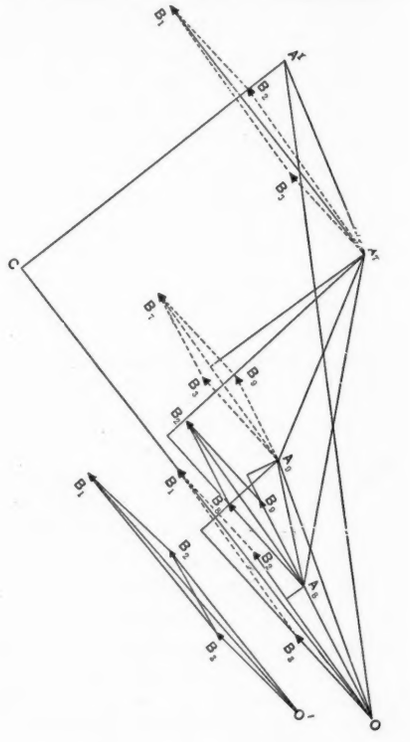


FIG. 120.—ALTERNATING MECHANISMS.

forth for the other circuits, and that the sum of the energy expended in all of the circuits is equal to 57,220 watts and to the power developed by the generator. The last horizontal line of figures given in the table applies to the generator E^I, and shows the equivalent constants of the whole system expressed in terms of impedance, resistance and reactance. The columns of resistance and reactance show that the circuit A_1A_7 has a resistance of 12.9 and a reactance of 3.6 ohms, and that the circuit has an impedance of 13.4 ohms. This circuit has then the smallest impedance of any of the circuits. On the other hand, the greatest impedance present in any one circuit is that peculiar to the circuit A_8A_7. This circuit has a resistance of 36.6, a reactance of 48.1, and an impedance of 60.4 ohms.

Now, in so far as the general distributing system shown in Fig. 117 is concerned, the circuits A_1A_7, A_2A_8 and A_2A_9

of Fig. 119 are line circuits, while the circuits A_7A_9, A_8A_7 and A_9A_8 are receiver circuits. Referring to the data tabulated in table 14, however, we find that the line circuits absorb twice as much power as the receiver circuits. This is a condition which will hardly ever have to be faced under practical conditions of plant operation. Usually, the line constants are much less than the receiver constants, and involve a waste of power in the lines not in excess of ten per cent of the power

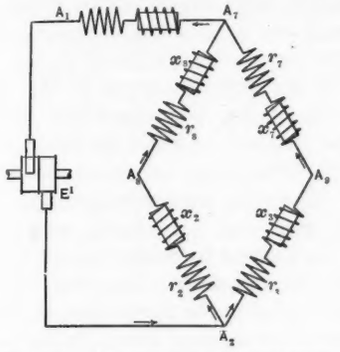


FIG. 121.—ALTERNATING MECHANISMS.

delivered to the system by the generator. With low line constants, the impedance of the circuits A_2A_8 and A_2A_9 would be small relatively to the impedance of the circuit A_8A_9; consequently, the difference of potential between the terminals A_8 and A_9 would also be small, and, therefore, but an inappreciable amount of current would flow in the circuit A_8A_9 when only the phase electro-motive force E^I is active. This fact enables us, when solving practical examples, to disregard the presence of such circuits as the circuit A_8A_9, and base the development of the preliminary phase diagrams upon systems having the general outline of connections presented in Fig. 121. The fact that it is possible to make this modification in the solution of practical problems removes the burden of difficulty in the way of their solution, as we are already quite familiar with the method of handling systems like that outlined in Fig. 121.

We will now take up the discussion of the solution of a mesh connected three-phase distributing system, following the general plan of attack just outlined by which the inner cross circuit is neglected. If we apply the principles already made familiar by the discussion on pages 149 and 180, we will obtain the three-phase diagrams shown in Figs. 122, 123 and 124. Here Fig. 122 represents the conditions which will exist in such a system as that shown in Fig. 117 when the E^I phase is alone active, and when the line constants are not large. In this case, the presence of the circuit A_8A_9 is neglected, and the circuits $A_7A_8A_2$ are taken as being in parallel with the circuits $A_7A_9A_3$.

The vector OA_7^I of Fig. 122 represents a pressure of 1,000 volts, which is initially assumed to be active in setting up a flow of current in the circuits $A_7A_8A_2$ and $A_7A_9A_3$ in parallel. This electro-motive force gives rise to the current OB_7^I in the circuits $A_7A_9A_3$ and OB_8^I in the circuits $A_7A_8A_2$. The resultant of these currents is represented by the vector OB_1^I, and this is the current which E^I must force through the line A_1A_7; consequently, the triangle of the electro-motive forces $A_7^IC_1^IA^I$ is developed from the known constants of the line A_1A_7, with the vector $A_7^IC_1^I$ parallel to the vector OB_1^I.

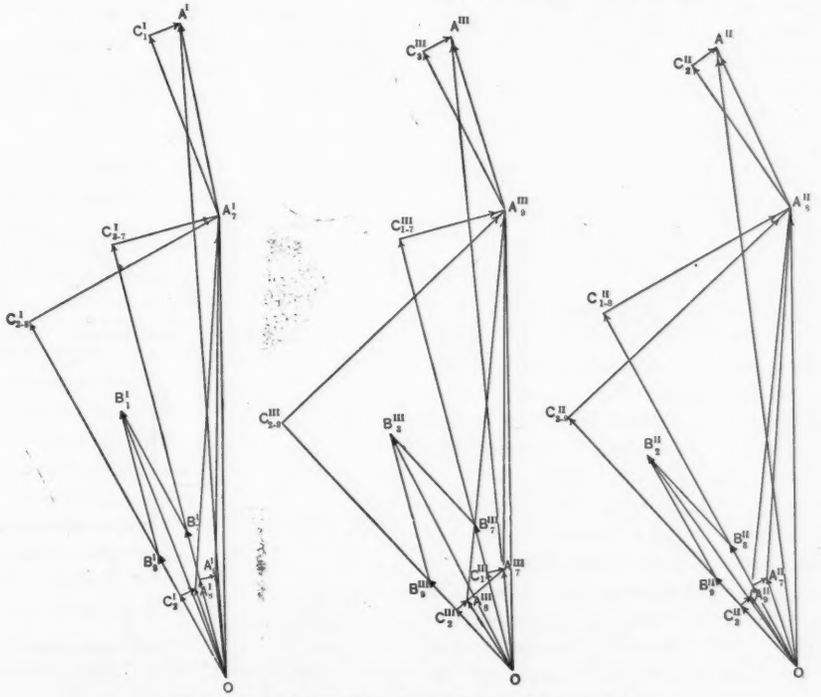
The electro-motive-force vector OA^I can now be drawn and measured for the value of E^I required to maintain 1,000 volts impressed upon the parallel lines, inasmuch as OA^I is the resultant of OA_7^I and $A_7^IA^I$.

To separate OA_7^I into its component parts and determine the exact voltage, apparent both at the receiver and line terminals, it is necessary for us to lay off the triangles of electro-motive forces of the lines A_2A_8 and A_3A_9. Since the current flowing in the circuit A_2A_8 is equal to $OB_8^I = I_2$, the vector $OC_2^I = I_2$, r_2 is laid off in phase with OB_8^I, and at C_2^I the perpendicular $C_2^IA_8^I = I_2$, x_2 is erected. OA_8^I is the drop in electro-motive force in the line A_2A_8, and, consequently, $A_8^IA_7^I$ the electro-motive force impressed at the terminals of the receiving circuit A_8A_7. By a corresponding construction, OA_9^I is determined to be the drop in voltage in the line A_3A_9, and $A_9^IA_7^I$ the electro-motive force appearing at the terminals of the receiving circuit A_9A_7.

Roughly speaking, the vector distance between the points A_8^I and A_9^I is a measure of the electro-motive force apparent between the terminals A_8 and A_9 of Fig. 117; and if, therefore, the circuit A_8A_9 was not omitted, the latter electro-motive force would be active in causing a current to flow in this circuit.

Following the same line of phase diagram development, the phase electro-motive forces E^{III} and E^{II} are both taken as being individually active. The electro-motive force E^{III} gives rise to the phase diagram shown in Fig. 123. The letter significations are sufficient to indicate the development of the diagram and the relation of its vectors to the several circuits of Fig. 117. In this case, the circuits $A_9A_7A_1$ and $A_9A_8A_2$ are in parallel, the circuit A_7A_8 being neglected. The potential difference between the points A_8^{III} and A_7^{III} of Fig. 123 would act upon the circuit A_7A_8 for the development of the circuit therein, were this circuit not omitted temporarily in the solution.

When E^{II} is active, the phase diagram shown in Fig. 124 results.



FIGS. 122, 123 AND 124.—ALTERNATING MECHANISMS.

The Technical Education Board of the London County Council has directed the higher education subcommittee to enquire and report (*a*) as to the need and present provision for special training of an advanced kind in connection with the application of science (especially chemistry and electricity) to industry; (*b*) as to what, if any, developments are needed to secure efficient training in these subjects for senior county scholars and other advanced students who desire to qualify themselves to take leading positions in scientific industries.

THE ELECTRIC TRANSMISSION OF POWER FROM NIAGARA FALLS—IV.

BY LEWIS B. STILLWELL.

The field poles are mild, open-hearth steel castings. Their permeability is practically equal to that of the field rings. The field winding of the first three alternators, as originally planned, consisted of copper conductors of rectangular section about equivalent to one No. 0 wire, B. & S. gauge. These conductors were covered with the usual cotton insulation and the coils were enclosed in ribbed brass boxes, from which they were insulated by sheets of mica with heavy strips along the edges where the coil would otherwise press most heavily against the box. The weight of each pole-piece, with its bobbin, is 2,800 pounds.

The bronze collector rings are built upon a separate cylindrical casting placed above the driver and securely fixed to the hub of the latter by heavy screws through a flange at its base. The brush-holder rods are held in place by a heavy iron bracket encircling the casting below the collector rings. This bracket rests upon the bridge which spans the machine and gives access to the collectors, brush-holders and brushes.

The field ring is carried by an umbrella-shaped steel casting, to the periphery of which the ring is secured by bolts as shown in the vertical section Fig. 2. The driver is turned on its outside surface and is strengthened by six deep ribs on the inside.

The shaft is tapered at its upper end to receive the driver and at its lower end a forged flange twenty-seven inches in diameter provides means for connection to a similar flange at the top of the turbine shaft. These flanges are held together by eight tapered steel bolts. The diameter of the shaft in the bearings is twelve and fifteen-sixteenths inches. It is tapered at the upper end to receive the driver and is also threaded to provide means for securing in place an iron casting which projects above the driver and carries the collector rings. A key-way is cut in the tapered end of the shaft and also in the bearing of the driver which is fitted to it, the driver and shaft being held together by a long, massive steel key.

Babbitt-lined bearings are used and provision is made for cooling the bearings by circulation of water through openings in the cast-iron bearing boxes. It is interesting to note that the babbitt-lined bearings of the alternators have been satisfactory from the start, while the bronze guide bearings originally provided for the shafts connecting the first three turbines with the corresponding alternators gave much trouble and have all been replaced by babbitt-lined bearings.

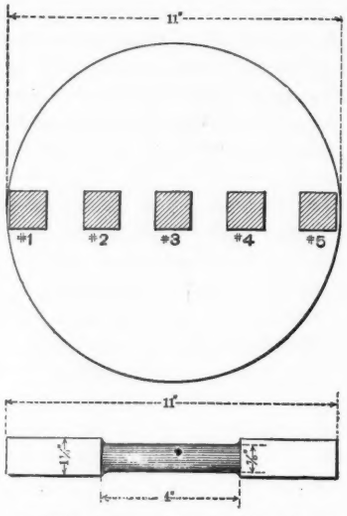


FIG. 5.—MANNER OF TAKING TEST SAMPLES.

The method employed in balancing the revolving element of the alternators was devised by Mr. Albert Schmid and is illustrated by Fig. 6.

A special shaft is placed in the bearings of the machine and supported at its lower end by a thrust-bearing into which oil is pumped at a pressure of about 1,000 pounds per square inch. This pressure is sufficient to lift the weight of the revolving parts, and the collars on the shaft are separated from the grooves of the thrust-bearing by a thin layer or film of oil. A small piece of tool steel is set into the upper end of the shaft, a half-sphere or cup being cut in the upper surface of this tool steel, in which is placed a tempered steel ball three-eighths inch in diameter. A large eye-bolt with a similar piece of tool steel, having in its lower surface a cup-bearing similar to that at the top of the shaft, is secured in the taper bearing of the umbrella-shaped driver, to the periphery of which the field ring is bolted. The entire weight of the driver and the ring is thus supported upon the small steel ball. A casting secured to the shaft serves to rotate the driver and ring with the shaft. The steel ball, as will be noted in the illustration, is placed a very short distance above the centre of gravity of the field and driver, and, under these conditions, the driver and ring being free to rock while rotated, a defect in balance is quickly shown. As a matter of fact, in the case of the first alternator, the driver at first assumed the position indicated by the dotted lines. This was

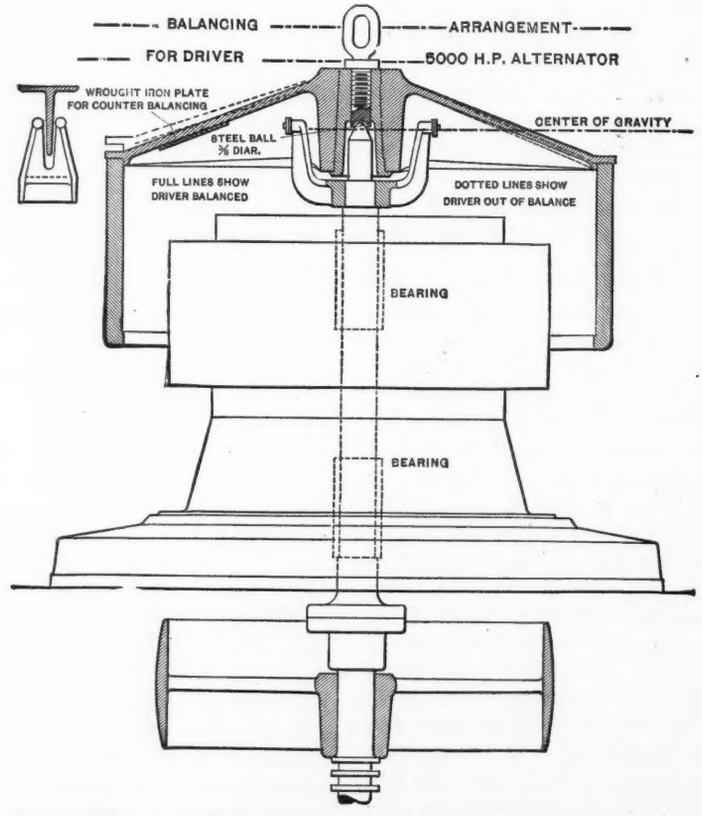


FIG. 6.—METHOD OF BALANCING REVOLVING ELEMENT OF ALTERNATORS.

corrected by riveting to the driver a wrought-iron plate, the weight of this plate and the distance from the axis of rotation being experimentally determined to obtain not only exact static balance but also exact running balance.

The driver is first balanced in this manner independently. The ring is then bolted to the driver, and the two balanced together as shown in the illustration. It is not necessary to balance the combination of the driver, ring and field poles, since the field poles and bobbins are separately weighed, and their weights adjusted to exact equality, while the positions in which they are bolted to the ring are exactly symmetrical with reference to each other and to the axis of rotation.

The sheet steel used for the core is 0.015 inch thick. Difficulty was experienced in securing the desired quality and it was found impracticable to obtain absolute uniformity in the large quantity required. To secure circulation of air, the armature core is divided horizontally into six equal parts, separated from one another by one-inch spaces, these spaces being maintained by brass spacing strips, whose position is approximately radial to the machine. Each layer of the core consists of eleven segments which are so placed that all joints in each layer are overlapped by the segments of the adjacent layers. The plates are annealed, but in the first three alternators are not japanned.

The laminated ring thus built up to form the armature core is held together by sixty-six bolts of nickle steel containing a high percentage of nickle which renders them practically non-magnetic. These bolts are carefully insulated from the core. The large discs or end-plates at the top and bottom of the armature ring are of brass. At the time of tightening the bolts the steel plates were pressed closely together by powerful hand presses. The entire ring constituting the armature core, when finally built up, was turned on the inner surface so as to accurately fit the ribs of the armature support, which was then heated and lowered into place against the flange on the support and, in cooling, of course, adjusted itself tightly into place against the ribs. The armature conductors are copper bars one and eleven-thirty-seconds inches by seven-sixteenths inch in section, the edges of the bars being rounded to a radius of about one-eighth inch. Two of these bars are placed in each of the 187 slots around the periphery of the armature core. The conductivity of the bars is above 100 per cent by Matthiesen's standard, the actual conductivity in the case of the second alternator being 102.6 per cent by that standard. The bars are encased in mica applied before they are put in place. The insulation is about three-thirty-seconds inch thick. The insulation of each bar was tested by connecting one terminal of an alternating potential to the conductor, while the other was connected to a layer of tin-foil wrapped about the tested insulation. The insulation of every bar was required to with-

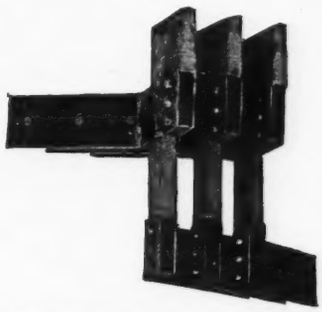


FIG. 7.—JUNCTION OF ARMATURE BARS AND CONNECTORS.

stand 15,000 volts, alternating, applied for a few seconds. The completed armatures were tested by the application of 8,000 volts, alternating, for a period of thirty seconds. The armature bars project above and below the core and connections are made by pieces of copper punched from large sheets and shaped into proper form by presses and iron moulds. These connections are insulated by mica and rubber insulating tape, the former being used only when connectors conveying considerable difference of potential are adjacent to each other. The connectors are secured to the armature bars by three wrought-iron bolts, the heads of which are countersunk in one side of the split connector, while the nuts are locked by upsetting the projecting ends of the bolts. Finally, the joints are thoroughly soldered. Fig. 5 shows the junction of six armature bars and connectors before they are soldered and insulated. The conductors are so connected as to form two complete circuits, each thoroughly insulated from the other and from the steel core.

The potential curve of one of the first three alternators during a half cycle, and, for purposes of comparison, a sine curve are shown in Fig. 6. The following interesting method was adopted in determining the form of this curve:

The machine was run at a very low speed so that the needle of an ordinary voltmeter connected across the terminals would follow the variations of electromotive force, increasing to a maximum, decreasing to zero, reversing and increasing to a maximum in the reverse direction. Readings upon the voltmeter were made at regular intervals and the results plotted, thus giving the curve of the machine.

This method of measurement requires a uniform and very slow speed. Variations of one or two per cent in the speed will cause corresponding variations in the electro-motive force. In the test the slow speed was obtained by winding around the field ring a wire rope, which was attached to the shaft of a vertical lathe. The lathe was run at a slow and uniform speed, winding up the rope, which was drawn from the ring, thus revolving the machine. Difficulty was experienced at first in obtaining a uniform speed when heavy iron wire was used instead of the cable finally adopted. The speed was irregular, due to stretching of the wire, as the friction to be overcome was not uniform at the slow speed. The adoption of a steel cable very nearly eliminated the irregular motion. The machine was belted to a direct-current motor supplied with current nearly sufficient to cause rotation, and the additional force was supplied by the cable which was able in this way to maintain a uniform speed.

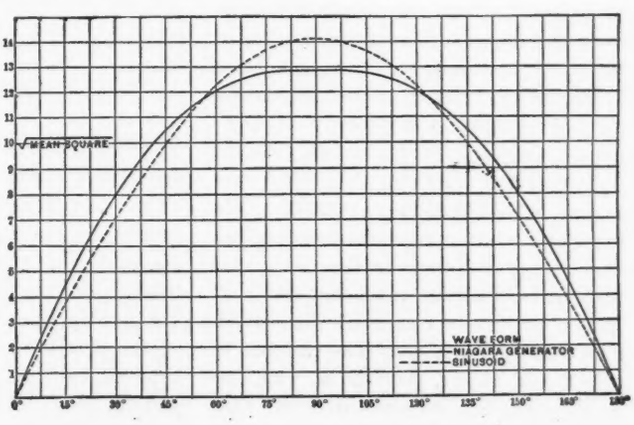


FIG. 8.—THE POTENTIAL CURVE FOR ONE OF THE GENERATORS AT NIAGARA FALLS.

The speed of the ring was about one revolution in ten minutes, giving one alternation in about fifty seconds. The speed of the machine is thus reduced from normal, 250 revolutions, to one-tenth revolution per minute, or in the ratio of 2,500 to 1, and the electro-motive force of the normal field charge is consequently reduced from 2,000 volts to 0.8 of a volt ef-

fective, or a little over one volt maximum. This electro-motive force could be reduced as desired by resistance in circuit with the voltmeter. In making the measurements a voltmeter was placed across each of the circuits and readings were taken at intervals of two and one-half seconds, as indicated by a signal. Observations were continued through several minutes, covering a number of cycles. The results were plotted, and the successive cycles which should be similar, if all the conditions remained constant and the observations were correctly taken, were superposed and the average adopted as the correct result. Variations in speed and in the time of taking readings, and in the readings themselves, were in this way found to be slight and were eliminated by taking averages. The voltmeter was a Weston milli-voltmeter with the zero of the scale in the middle so that both positive and negative readings could be taken without changing connections.

The wave form of the machine was also calculated from the drawings. The calculated and measured curves agreed very closely.

V—THE FIRST THREE ALTERNATORS UNDER TEST AND IN SERVICE.

The manufacturer guaranteed that the total electric and magnetic losses, when delivering 3,730 kilowatts, should not exceed two and one-half per cent of the power required to drive the alternator. Before shipment, therefore, tests were made in the shops at Pittsburgh to determine the losses due to magnetization of the armature core, the alternator being supported on a thrust-bearing into which oil was pumped at a pressure of 1,000 pounds per square inch to support the weight of the revolving field which was driven by a direct-current motor. The fields of the motor were separately excited. The energy delivered to the motor was measured by Weston ammeters and voltmeters previously compared with standards, and simultaneous observations of speed, field charge, potential at terminals of alternator and current delivered to the motor were recorded. These tests were repeated a number of times and satisfactory agreement of results was obtained. The energy required to magnetize the field was accurately measured in the course of full load tests carried out in the power-house where a large rheostat was constructed and used for loading the alternator. The loss due to resistance of the armature conductors was calculated from the measured resistance and the known mean current. No allowance was made for possible eddy currents in armature conductors. The losses and efficiency in the case of the first three alternators thus determined were as follows:

Loss in armature core	42 Kw.
C^2R loss in armature	20.2 Kw.
C^2R loss in field	11.4 Kw.
Total	82.6 Kw.
Kilowatt output	3730 Kw.
Kilowatt input	3813 Kw.
Kilowatt efficiency	97.82 %

Much difficulty was encountered in securing proper circulation of air throughout the interior of the machine. When the alternators were designed it was expected that a plenum would be established in the interior of the armature, and that the air would flow radially outward through the armature core. Six holes in the driver were provided for ventilation, and above each of these holes a copper ventilating hood, opening forward—*i. e.*, in the direction of rotation—was placed.

The space within the armature support being open at the top, as no hatches are used to close the openings between the five radial arms at the top of the bearing support, and as it was then deemed inadvisable to reduce the strength of the ring by providing openings through it for radial escape of the air, the reasons why the air insisted upon flowing upward and along the outer surface of the armature and then radially inward through the openings in the armature core, finally escaping through the holes in the driver at the top, are now sufficiently evident. The position of the hoods on the top of the driver was reversed, and they thus act as exhaust or suction blowers to draw the air out of the interior of the machine. It was deemed inadvisable to close the space between the five radial arms at the top of the bearing support, and after the hoods were reversed excellent ventilation, except at the top of the armature, was secured by the inward flow through the armature, the total amount of air passing through the machine being not less than 9,000 cubic feet per minute. At the top of the armature, the cast-iron armature support, being designed for an expected plenum inside, interfered to some extent with the flow of air through the upper ventilating space in the core, as a consequence of which the temperature as measured at the top of the core exceeded the guaranteed limit; *viz.*, fifty centigrade degrees above surrounding air by about ten centigrade degrees. Experience has shown, however, that this temperature certainly does not seriously endanger and apparently does not practically injure the insulation used.

As I have stated, the conductors used in winding the field coils originally designed for the first three alternators were covered with cotton insulation. Under test the temperature of these coils, as determined by thermometer applied to the outside of the shells and as determined by measurement of resistance, was well within the guaranteed limit—*i. e.*, fifty centigrade degrees above surrounding air; but after the machines had been operated for a time it was found that the exciting current was gradually increasing from week to week and from month to month. Investigation showed that this was caused by excessive heat in the middle of the coils, which was gradually charring the cotton insulation and causing a part of the current to leak across from one layer to another, instead of following the conductor.

The coils which had proved defective were replaced by coils of a new type, in which the conductor is a copper strap one and three-sixteenths inches by one-sixteenth inch in section, bent on edge, successive turns being insulated by micanite placed between them as in commutator construction. The edges of the strap conductor are exposed to the air. This type of construction is now extensively used, but I think was first used in these alternators. There are four layers of turns separated from each other by insulated spacing-rods, the whole being enclosed in a metallic case provided with abundant openings for circulation of air. These coils in service under full load rise only twelve centigrade degrees above surrounding air, as determined by thermometer and by measurement of resistance.

The first alternator was put into commercial service October, 1895, the second alternator following a few months later, and the third beginning its commercial work in 1897. They have been in practically continuous use ever since they were started, being shut down regularly once a week for a few hours, when they are thoroughly cleaned and inspected. Allowing for all stoppages, the use of the first three alternators to date in actual running time is more than equivalent to five years' absolutely continuous use, and in that time there has been no failure in any part of any one of the three alternators which has caused one minute's interruption of service. This excellent record is undoubtedly due in part to the system of inspection and testing adopted, each alternator being thoroughly cleaned once a week, while at intervals of about three months the armatures are subjected to a test potential of 6,000 volts, and any armature bars having insulation which will not

withstand this test are removed and replaced by others. This, in my opinion, is the proper manner to take care of electrical machinery. The total cost of maintenance of these alternators since the field coils were replaced has not exceeded one per cent, whereas if they were not kept in first-class condition it is not difficult to imagine how accidents might occur, causing much and expensive damage.

VI—ALTERNATORS 4 TO 10.

Alternators 4 to 10, inclusive, were designed in 1896. The first alternators had been erected, tested and were in commercial service. As compared with the first three alternators, which were designed in 1893, the following differences were introduced:

The thickness of the field rings was increased from four and seven-sixteenths inches to five inches. A slight reduction in weight of the shaft-connecting turbines and alternator made it possible to increase weight of the revolving field by about 2,000 pounds. The additional weight was put into the ring as being most effective there, both with respect to strength and flywheel effect. The increased thickness made it possible so to do without reducing the factor of safety in the ring below the standard established for the first three alternators. The heads of the bolts which hold the field poles to the ring were countersunk.

Tests of additional samples of nickle steel having demonstrated that an alloy containing four and one-half per cent nickle would be satisfactory with respect to permeability and ductility, while superior with respect to ultimate tensile strength and elastic limit, steel containing four and one-half per cent nickle was used for the rings of the alternators 4 to 10.

The winding of the armature was modified with a view to securing an increase in efficiency and closer regulation, the new winding consisting of 334 bars placed in an equal number of slots in place of 374 bars placed in 187 slots.

The clearance between armature and field was reduced from one inch to seven-eighths inch.

For the old method of building up the armature core, which involved the use of nickle-steel bolts, the now generally adopted method of dove-tailing the sheet-steel plates of the armature into grooves on the outer periphery of the cast-iron support and holding the complete core in place by end-plates, secured by means of circular keys, was adopted. This improvement in the method of manufacture in connection with the more uniform quality of steel obtainable, the painting of the plates by an insulating varnish and the more accurate punching and fitting of the plates, which made it unnecessary to do as much filing of the slots as was required in the case of the first three alternators, resulted in a reduction of the core loss amounting to about fifteen kilowatts. Instead of six horizontal one-inch ventilating spaces through the armature core, twelve spaces of about one-half inch were provided, and the openings through the cast-iron armature support were extended in such a way as to permit more effective ventilation in the upper part of the core.

As regards shaft and bearings, hollow-forged nickle-steel shafts were substituted for the solid shafts used in the first three alternators and the iron shell surrounding the babbitt-lined bronze bearings was cored out to permit circulation of water and was not split, this improvement making it absolutely impossible for the oil and water used in cooling and lubricating the bearings to get mixed, to the detriment of the oil.

The reduction in losses, particularly in core loss, implied, of course, a reduction in heat to be dissipated, and, as by reason of increased thickness, the rings were stronger than those used for the first three alternators, it was thought safe to provide openings for ventilation along the upper edge of the ring where it is secured by bolts to the driver. It was decided, therefore, to omit the ventilating hoods from the new alternators, but as this omission involved some uncertainty as to the ability of the machine to operate within the desired temperature limit, provision was made for cooling the interior of the machine by water circulating through the cast-iron armature support. When the machines were completed and tested, however, it was found that they would operate within the required temperature limit without the use of water.

VII—PERFORMANCE OF ALTERNATORS 4 TO 10 UNDER TEST AND IN SERVICE.

The method adopted for determining the efficiency of alternators 4 to 10 was the same as for the first three alternators; *i. e.*, the core loss was determined by measuring the increase of power required to drive the alternator with charged field as compared with the power required to drive it at the same speed with no field charge; the I^2R loss in armature was calculated from the mean current and the measured resistance; and the I^2R loss in field was also calculated from measured current and resistance. To the core loss at no load, twenty per cent was added to cover increase due to distortion of magnetic field in the armature under full load and for partial loads the measured core loss at no load was increased proportionately. The following tabulated statement of electric efficiencies of alternators 4, 5, 6, 7 and 8 is an exhibit gratifying to the manufacturer, to the purchaser and to the members of the Institute, as showing what electrical engineering science in America was able to accomplish in 1896, within twelve years of the time when alternating-current electrical machinery first appeared within the horizon of practical application.

Total Amps. at 2,400 Volts.	Elec. Eff. Alt. No. 4.	Elec. Eff. Alt. No. 5.
400 amps.	96.20 per cent.	95.99 per cent.
800 "	97.65 "	97.6 "
1,200 "	98.00 "	97.96 "
1,600 "	98.1 "	98.07 "
2 000 "	98.12 "	98.06 "

The first three alternators, designed in 1893 and 1894, were to all intents and purposes as effective as the fourth and succeeding alternators, except that methods of manufacture were not then sufficiently perfected as regards treatment and handling of armature cores to permit reduction of the core losses within the limit established by the succeeding alternators, the result being that the efficiency of the first three alternators was about three-tenths of one per cent lower than the efficiency of the others as shown in the table; in other words, the electrical full load efficiency of the first three alternators was about 97.8 per cent, while the electrical efficiency of the last seven alternators averages fully 98.1 per cent. The mechanical friction—*i. e.*, air friction and bearing friction—amounts to 1.1 per cent. The net commercial efficiency of the first three alternators is, therefore, 96.7 per cent, and that of the last seven alternators, ninety-seven per cent. Surely such results as these, considered in connection with the excellent record of these machines in practical operation, leave no ground for belief that the designers of 5,000-horse-power alternators are in any way less certain to attain desired results than the designers of large engines or turbines or bridges.

Electric Locomotive.

An electric locomotive operated by trolley has recently been built by the Baldwin Locomotive Works. It was built for the Atlantic Coast Lumber Company. The gauge is standard. Driving-wheels are 30 inches diameter; journals, 3¾ inches by 7 inches; wheel base, 5 feet 6 inches. There are two 74-h.-p. motors, 220 volts pressure. The full-load speed is about six miles per hour. Full-load draw-bar pull on level, 4,300 pounds; starting draw-bar pull on level, 5,200 pounds, with clear, dry rail.

Drawbacks on Exported Electrical Apparatus.

Among the orders recently issued by the Treasury Department was one instructing the collector of customs at New York to allow, on the exportation of certain electrical apparatus known as generators, motors, alternators, commutators, armatures and rheostats, manufactured by the General Electric Company, of Schenectady, N. Y., in the manufacture of which no other than imported unmanufactured or rough-trimmed mica has been used for insulation purposes; also on the exportation of mica manufactured into sheets, plates or other forms, wholly from the same description of imported mica, for use in foreign countries as electrical supplies, a drawback equal in amount to the duty paid on such imported material used, less the legal deduction of one per cent.

The formalities to be observed in this case may not be without interest at this time. The drawback entry must show, separately, the marks and numbers of the shipping packages, the name of the apparatus contained therein, the name, location, form and dimensions of each mica part, the number of such parts in each apparatus, the total weight of mica appearing therein, the percentage to be added thereto to compensate for loss in manufacture, and the total weight of mica in condition as imported consumed in the manufacture, ascertained in detail as indicated in the drawback entry, a form of which, together with the manufacturer's sworn statement, dated July 12, 1901, and exhibits marked from "A" to "H," inclusive, is now on file in the office of the collector.

When mica manufactured into sheets, plates or other forms is expected, the entry must show, in addition to the usual averments, that the several mica parts or forms of electrical supplies described therein were manufactured of material and in the manner set forth in the manufacturer's sworn statement and the exhibits hereinbefore mentioned.

In liquidation the quantity of mica in condition as imported which may be taken as a basis for allowance of drawback may equal the quantity declared in the drawback entry, officially verified, but in no case shall the allowance exceed one pound for every ten cubic inches of mica consumed in the manufacture, nor shall the percentages to be added to the weight of the exported mica or mica parts to compensate for waste incurred in the manufacturing processes, exceed those shown in exhibit "A," hereinbefore mentioned, for the corresponding description of mica parts in the exported apparatus, or if mica in the form of electrical supplies, as the case may be.

Samples of the different forms of mica supplies may be taken, or sworn samples of the same and of the mica parts appearing in the exported apparatus may be furnished, as ordered by the collector, for such determinations as may be considered requisite.

Domestic Lighting Installation Wanted.

To the Editor of the Electrical Review:

I have an artesian well, and by putting in a hydraulic ram I can lift into a tank, say, forty feet high. Will you kindly put me in communication with some manufacturer of water motors and dynamos who could furnish the outfit by which I could light my residence from a 3,000-gallon tank of water forty feet high.

Thos. M. Ferguson.

Hattiesburg, Miss., October 14.

Testing Rail-Bonds.

To the Editor of the Electrical Review:

It will be greatly appreciated if you will furnish me with information of the best apparatus for and method of testing the resistance of bonds between rails, while such rails are in use and carrying from zero to fifty amperes. J. M. Oram.

Dallas, Tex., October 15.

A Simple Astatic Galvanometer.

A remarkably simple astatic galvanometer is described by M. G. Lippmann in the *Journal de Physique*, and abstracted in *Nature*. It consists essentially of a fixed coil, or in practice two coils, and a needle suspended in such a way as to be capable of displacement parallel to itself. The needle is placed with its axis coinciding with that of the coils, and pointing in the plane of the magnetic meridian. It is suspended by a thread from one arm of a torsion balance. Now the earth's magnetism has no tendency to produce displacements of pure translation in a magnetized needle, and since it is these displacements which alone are observed, it follows that the earth exerts no force in opposition to that produced by the current in the coil; the apparatus is therefore perfectly astatic.

In the Technical Institute at Charlottenburg it is reported that restrictions will be placed on the attendance of foreign students. There has recently been much complaint regarding the number of foreign students in Berlin, Munich and other technical schools. The Russians are especially the object of the restrictions. Americans there are less numerous than they were formerly.

Movable Wireless Telegraphy Apparatus.

Mr. Marconi has designed a portable outfit especially adapted to requirements in wartime as an outcome of experience gained in the use of wireless telegraphy for military purposes in South Africa. The inconvenience caused by the absence of the poles which are essential in his system led Mr. Marconi to devise a portable installation, and for some time past he has been experimenting with huge cylinders to act as receivers in lieu of the high wire. These cylinders are said to have proved to be more efficacious for the transmission of messages over short distances than the ordinary apparatus. When the electric currents are excited the waves at first oscillate very rapidly and violently, but in a few moments the vibrations die down, or become damped, in much the same way as the wire of a piano decreases its vibrations after a note has been struck. It is imperative that these vibrations should be sustained as much as possible, in order to travel over a long distance, and to ensure this end there must be a great capacity in the sending instruments. The effect of the cylinder is to render greater capacity than the ordinary aerial wire, and consequently more sustained vibration is obtained. The rear part of the automobile, which is of the Thornycroft steam-motor type, is fitted up as an operating room, containing instruments and electric batteries. Upon the roof of the car the long cylinder is placed, and the arrangements are such that, when not required, the cylinder may be laid down flat upon the roof, out of the way. The cylinder is about 25 feet in height. It is constructed of metal and thoroughly insulated, and can be raised or lowered instantaneously. The car, owing to the strength of stability of its construction, is a typical vehicle for military work where rough roads are encountered, and makes a speed of from 12 to 14 miles an hour. One special recommendation of this novel installation is that communication can be maintained while the vehicle is traveling. The maximum distance over which messages can be despatched and received by means of it is 20 miles at present, which is taken to be generally sufficient for military purposes. The inventor, however, is still continuing his experiments with a view to increasing this distance. The cylinder performs exactly the same functions as the aerial wire, even in connection with the tuned or synchronized messages. The results of the experiments will be watched with interest.

The Works of the Stanley Electric Manufacturing Company.

The New Manufacturing Plant at Pittsfield, Massachusetts—Buildings and Equipment—Machinery and Methods of Manufacture—Output—Organization.

THE STANLEY Electric Manufacturing Company has been for many years located at Pittsfield, Mass., and the history of its growth is not unlike that of other large American manufacturing companies, especially those working in the electrical field. The company manufactures the "S. K. C." system of electrical apparatus, these letters representing the initials of the original inventors, Messrs. William Stanley, John F. Kelly and C. C. Chesney. Beginning in a small way, with a few machine tools and constantly adding both to the variety and amount of its output, the company has several times outgrown its buildings and finally has removed its works from cramped quarters in the middle of the town of Pittsfield to a new site, three-quarters of a mile out of town, where there is room for further expansion. Upon this site, in a space covering thirty acres of ground, the company has erected the new buildings which form the subject of this article. The general arrangement of the grounds and buildings may better be understood from the accompanying illustration, showing them in perspective, than from any description.

The main building, alongside of which are located the numerous "sawtooth" buildings, is the general machine shop, this structure being over 500 feet long. It is composed of a two-story side section and a wide bay, of which an interior view is shown in one of the accompanying illustrations. The crane spanning this bay has a main hoist of thirty tons capacity and an auxiliary hoist of five tons capacity and was built by the Wheeling Foundry Equipment Company. The hoist and crane are operated by direct-current motors. At the side of this great bay is a smaller bay covered by a gallery, and on both floors of this portion of the building the lighter classes of machine tools are assembled. The storeroom for finished parts and materials is also located in the gallery.

Upon the main machine floor is done the larger and heavier work of assembling machinery and transformers. The illustration gives a good general view of this part of the shop, showing the class of machinery that is handled in it in considerable detail. At the further end of the main bay, as it is shown in the illustration, there is now being erected one of the largest boring mills that has ever been constructed and there are several others of these important tools on the main floor. Excellent illumination for this room is accomplished by a skylight and clear story. The arrangement of the gallery is excellently shown in one of the smaller illustrations, which gives also a glimpse of some of the intermediate-size machine tools on the main floor and shows the arrangement of arc lamps for illuminating the building at night.

In accordance with modern practice, there are no railway tracks on the floor of the main bay, all of which is available for

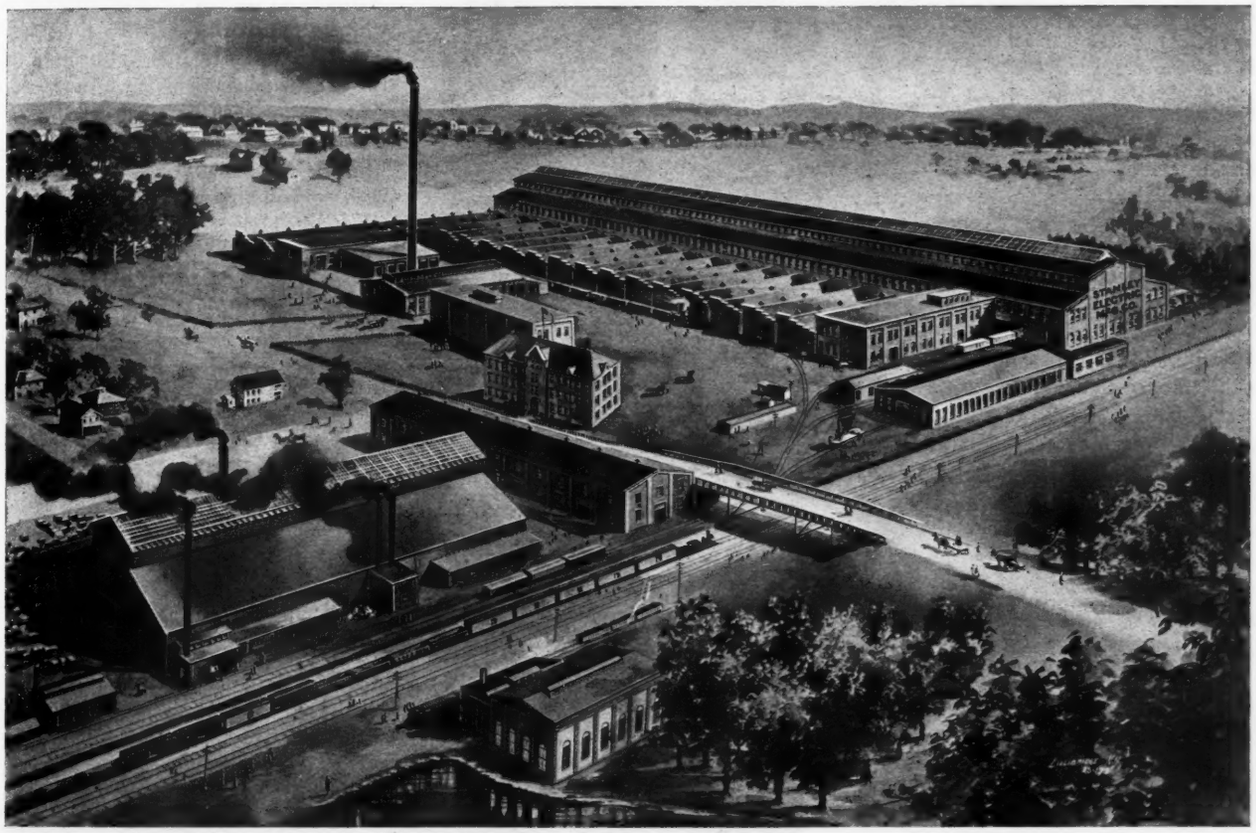


FIG. 1.—GENERAL VIEW OF THE STANLEY ELECTRIC COMPANY'S WORKS AT PITTSFIELD, MASSACHUSETTS.

the assembly of machinery. All of the transportation of parts and tools is accomplished by the overhead crane, except that pneumatic hoists are used to a limited extent for some of the smaller handling.

In the gallery of the main machine shop, at one end, are found the punch presses shown in one of the illustrations. In this department all of the laminated ironwork is manufactured in the rough for assembly in dynamo and motor frames, transformers, etc., on the main floor or elsewhere. The tool-making department, wherein are constructed the elaborate punches and dies so necessary in the manufacture of modern alternating-current machines, as well as a number of other tools, is also located in this gallery and forms the subject of another of the smaller illustrations.

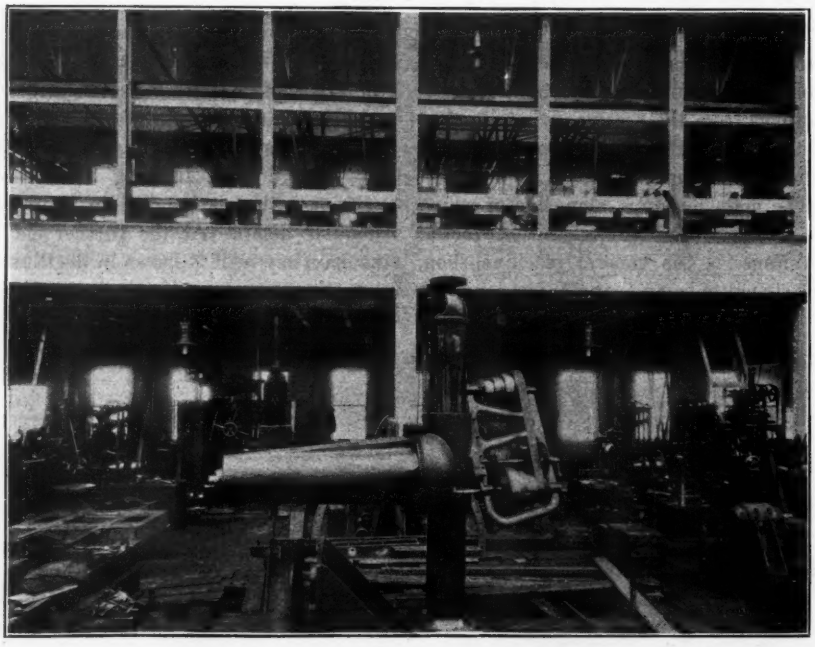


FIG. 2.—SHOWING GALLERY IN MAIN SHOP.

Near the middle of the gallery, and in a point conveniently situated for quick distribution to all parts of the establishment, is located the storeroom shown in Fig. 3. Here a very complete system of cataloguing and oversight prevails, the various parts which enter into the construction of the company's numerous manufactures being kept here in stock as they are manufactured, and issued from this department for assembly as required. The bins in which such supplies as coils, machine screws and other of the lighter parts are stored, are excellently shown in the illustration of this department.

In a large extension off the main machine shop is situated the department for winding and insulating coils. A good view of the busy winding room is shown in one of the illustrations, the work in this department being carried on in the manner which has now become standard. All coils for fields and transformers and for the various elements of induction motors are made here, the coils being wound up of round or square wire as the design determines, and subsequently insulated with reference to the duties they are to perform. Individual winding lathes of a simple but satisfactory pattern are employed, and the work completed in this department is passed along to the taping and insulating departments adjoining it. For taping the majority of coils a dry tape is used, the coil being subsequently soaked in insulating compound under pressure. Formerly all of the work of taping coils was done by hand, but of late an exceedingly ingenious taping machine has been put to work especially for use in connection with transformer coils, of which the Stanley company's output is very large. This machine, by the use of a peculiar circular shuttle, tapes such coils with great accuracy and uniformity and accomplishes an important saving in the labor required for the production of the output.

The coils having been duly taped and in the condition shown in the foreground of Fig. 10 are taken to the coil-insulating department, shown in that illustration, where they are filled with insulating compounds in the cast-iron vats shown near the centre of the engraving. In these vats the coils, placed under the melted compound, are first subjected to a vacuum which withdraws the air from them and then to pressure which forces the compound into every part of the coil. Of course, coils intended for oil-insulated transformers are not subjected to this filling process.

Returning now to the general plan of the works, the idea of power generation at a central point and its transmission and distribution through the various departments of this large industry is carried out to the fullest extent and in its application to the necessities of a shop of this character some extremely interesting and novel features are developed.

FIG. 3.—STOREROOM IN GALLERY OF MAIN SHOP, STANLEY WORKS.

The power-house, which is located at one side of the works enclosure, is a handsome brick structure consisting of boiler and engine room. Its interior is well shown in the two accompanying illustrations. The boiler room contains four return-tubular boilers, made by the D. M. Dillon Steam Boiler Works, of Fitchburg, Mass., these boilers being set in brick and having an overhead smoke header, as the illustration shows. An interesting auxiliary in the boiler room is a live steam purifier, wherein the feed water is sprayed and divided and subjected to the temperature of the issuing steam causing it to deposit foreign substances in solution in the purifier rather than in the boiler. A large supply of water for feed and condensing purposes is available from a lake near-by, but as this water contains a certain proportion of lime and magnesia the purifying apparatus mentioned above has been installed to obviate scaling the boilers. A pressure of 135 pounds is carried on these boilers to feed the engines in the adjoining engine room.

This room contains at present two 100-horse-power, tandem compound, non-condensing engines and one McIntosh & Seymour tandem compound, thirteen by twenty-six by thirty-six inches, working condensing, and indicating about 400 horse-power. These engines operate together on the jack shaft at one side of the room, and from the latter are driven eight main dynamos and four exciters.

As many of the tools in the machine shops and elsewhere through the works are driven by polyphase motors a highly ingenious system of speed regulation has been introduced, consisting in supplying to each motor currents of different frequency. To accomplish this result the installation in the power-house consists of the following apparatus:

One	288-kilowatt,	two-phase	133-cycle	generator.	
One	216	"	"	133	"	"
One	100	"	"	94	"	"
One	100	"	"	111	"	"
One	100	"	"	120	"	"
One	100	"	"	133	"	"

The equipment mentioned above comprises only the alternating generators, but in addition to them, in order to supply direct current for various purposes for which this is necessary, there are installed one Northern Electric company's 200-kilowatt, 220-volt machine, used on the testing circuits, and one Eddy four-pole, 120-kilowatt, 220-volt machine for shop motors and cranes.

In all, there are four exciters installed, one of three-kilowatt, one of four-kilowatt and two of ten-kilowatt capacity.

By an arrangement of quills and clutches on the jack shaft it is possible to operate practically any combination of these engines and dynamos and to obtain the most extraordinary flexibility of output. The main switchboard on which the current of various characters is handled is shown in the far corner in the illustration of the engine room. An overhead transmission line extends from this board to the various departments of the works. The engine room is spanned by a hand-operated crane of ten tons capacity and is a large and well-lighted room, admirably fitted for its uses.

FIG. 4.—MAIN BAY OF HEAVY MACHINE SHOP, STANLEY ELECTRIC COMPANY'S WORKS.

Among the other departments and buildings situated on the company's grounds may be mentioned a forge shop in which are installed the usual appliances and a pattern shop, wherein all of the woodwork necessary is done. A vault lined with concrete is situated near the centre of the works for the storage of oil. Near this is a gas-generating house wherein is located a Springfield gas machine for making the fuel gas used in many of the operations of the machine shop and other

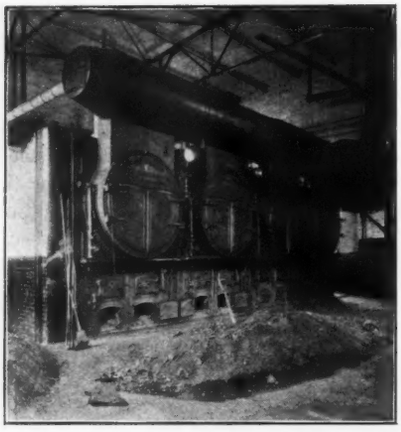


FIG. 5.—BOILER ROOM.

shipped from the other end of the main shop after passing through it. The whole system may be described as a main passage, consisting of the large shop, through which the heavier parts move while the auxiliary departments contribute their share at various stages of this progress until the apparatus is finished at the further end of its passage through the main shop. In this way the greatest economy of time and labor is secured and the transportation of heavy parts minimized.

It should not be forgotten, in concluding this hasty sketch of these fine works, that a large number of important minor auxiliaries are installed for facilitating

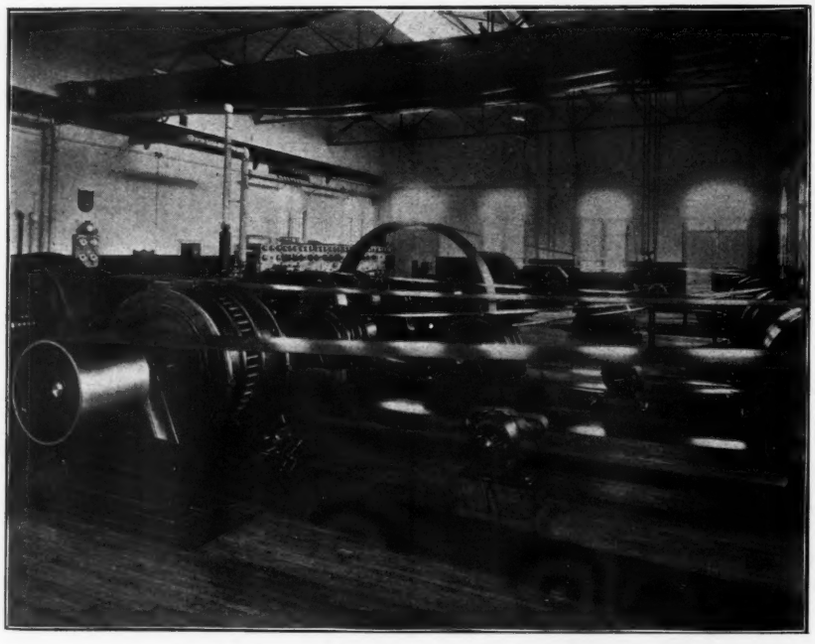


FIG. 6.—CENTRAL POWER STATION, STANLEY WORKS.

departments. A handsome office building is now in course of erection on the grounds and in this will be grouped the executive offices of the company, its engineering offices and drafting rooms.

Railway tracks from the Boston & Albany Railroad, which runs alongside of the works land, come to the various departments and a trolley car line runs from the works to the downtown section of Pittsfield.

The design of these works is such that the various smaller parts are manufactured in buildings and departments adjacent to one side of the main machine shop. Heavy castings are received at one end of the large bay and machine work upon them is done on the floor of this large shop. In the middle of it the parts contributed by the various auxiliary departments meet the finished frames of the apparatus for assembly and the finished machine is

and ensuring the rapid progress and complete standardization of the work at all stages. Tests are carried on at various stages of the manufacture, up to and including the final test runs of complete apparatus. It will be remembered that the Stanley Electric Manufacturing Company has been identified prominently with very high potential alternating-current work and has furnished the apparatus for a large number of power transmissions using voltages of the highest attempted in practice. For this reason much of the apparatus has to undergo exceedingly severe and difficult tests while the requirements for insulation are unusually severe, and on this account great attention is paid and much care is taken with testing, which forms an exceedingly important part of the work done at Pittsfield. The building of transformers is also an important branch of the company's manufacture, and these are subjected to very rigid and severe tests for insulation, efficiency, regulation, etc. The company was a pioneer in polyphase work in the United States, and has just been awarded a gold medal at the Pan-American Exposition for high-tension alternating-current apparatus.

The whole works is equipped throughout with the sprinkler system and standpipes for fire protection and with the Clark automatic intercommunicating telephone system. The works installation as a whole is one of the most complete and interesting in the United States and is an excellent example of the American idea of concentrated production and the adaptation of all the elements of a manufacturing industry to work together for the rapid, convenient and economical production of a high grade of standardized output.

FIG. 7.—COIL WINDING DEPARTMENT.

FIG. 8.—TOOL MAKING DEPARTMENT, STANLEY ELECTRIC WORKS.

Development of Water Power in New Zealand.

Great strides in the development of water power for electrical purposes are being made in New Zealand. The latest project on foot is to utilize the water of the Wiamakariri River for generating electricity for the proposed electric tramways at Christchurch and for electric lighting. In accordance with instructions, Mr. Robert Hay, M. I. C. E., has prepared a report for the Christchurch corporation on the subject and of the two schemes submitted to him, he recommends that known as the George bridge project. The race to be constructed at the point of intake will be about six miles in length. A good site has been selected for the power station on the banks of the river, and the engineer considers that a permanent foundation for the building and machinery may be obtained without risk of encroachment by the river. The power required at Christchurch is 3,000 horse-power, for which Mr. Hay estimates it is necessary to provide 5,000 horse-power at the generating station. The fall at the point of delivery having been fixed at 90 feet, the required flow of water will be 489 cubic feet of water per second, and allowing seven and one-half per cent for sundry losses by bends, etc., the capacity of the race must be equal to a discharge of 525 government heads of water. Dealing with the subject generally, Mr. Hay draws attention to the danger of interferences with supply of power through interruptions of the water supply from various causes. He, however, considers the scheme quite feasible, and thinks the actual works for conveying 500 to 600 heads of water from the Wiamakariri to the site of the proposed power-house can be successfully carried out, and utilized for the purpose of providing power for the generation of electricity for transmission to Christchurch. He estimates the cost of the work from the intake at the Wiamakariri to the pipe head at the termination of the race, including inlets, tunnels, race excavation, concrete lining, benching, new race and piping at £54,700. Turbines, with connections, generators, switchboards, transformers, exciters, meters, buildings, etc., would also have to be estimated for, but with these Mr. Hay does not deal. He recommends, in conclusion, that the corporation should lease or sell the concession to a private syndicate to carry out the scheme, reserving a right of purchase.

FIG. 9.—PUNCH PRESSES IN MAIN SHOP GALLERY, STANLEY ELECTRIC WORKS.

Tariff on Electrical Machinery and Apparatus for the Philippines.

By authority of the President of the United States, and with the approval of the Secretary of War, the Philippine Commission has enacted a new tariff law for the Philippine Archipelago. It is known as the Tariff Revision Law of 1901, and will take effect on November 15, 1901. Merchandise in transit at the time the revision goes into effect may be entered under the provisions of law existing at the time of shipment. This privilege, however, will not be extended beyond the period of sixty days after the date of the enforcement of the new law.

The new rates of electrical machinery and appliances are as follows:

Apparatus and appliances (not machinery) for electric lighting and power: Switches, cutouts, lamp sockets, shade holders, rosettes, plugs, brushes of copper and carbon, wet and dry batteries complete, tapes and compounds for winding wires, testing sets, testing bells for current, arc lamps and fittings for same, fuse boxes, insulating coils and all insulating materials not elsewhere expressly provided for, $3 per 100 kilos, net weight.

Galvanometers, ampere-meters, voltmeters, $25 per 100 kilos, net weight.

Only articles used exclusively in the generation and distribution of electric currents for light or power shall come under this classification.

Storage batteries for lighting or power, $25 per 100 kilos, net weight.

Dynamos, generators, exciters and all other machinery for the generation of electricity for lighting or for power, also transformers, $5 per 100 kilos, net weight.

Incandescent lamps, electric, mounted or not, $2 per 100.

Porcelain, plain, in electric insulators and other similar articles, not decorated, $4 per 100 kilos, gross weight.

Cables, 75 cents per 100 kilos, net weight.

Copper and alloys of copper in wire, galvanized or not: One m.m. or more in diameter, $4.50 per 100 kilos, net weight. Less than one m.m. in diameter, $4.50 per 100 kilos, net weight. Silvered or nickled, 35 cents per kilo, net weight. Copper and alloys of copper in wire, covered with textiles, not elsewhere provided for, or with insulating materials, cables for conducting electricity over public thoroughfares, $5 per 100 kilos, net weight.

Carbons prepared for electric lighting, $5 per 100 kilos, gross weight.

Automobiles for passengers and merchandise, $60 each.

Submarine telegraph cables are free of duty, subject to the formalities prescribed in each case by the customs authorities.

The metric system of weights and measures as authorized by Sections 3,569 and 3,570 of the Revised Statutes of the United States, and at present in use in the Philippine Islands, is to be continued.

New Steam Generator in France.

The following interesting information is sent by United States Consul Hilary S. Brunat from St. Etienne, France: There is a tendency among constructors to increase steam boiler pressure in order to allow the use of smaller cylinders. French locomotive boilers already carry from sixteen to eighteen kilogrammes (thirty-five to thirty-nine pounds) ordinarily. My attention has been attracted to a company that is being formed with the object of manufacturing and introducing a new steam generator which will ensure a pressure variable from twenty to eighty kilogrammes (forty-four to one hundred and seventy-six pounds).

This powerful generator, constructed by M. Serpollet, is made of cast steel, fused at 1,800 degrees centigrade. Within, it is an arrangement of non-capillary tubes, and it is in these that the instantaneous vaporization is effected without danger of escape, up to a pressure of eighty kilogrammes (one hundred and seventy-six pounds). The apparatus placed in the fire-box constitutes a sort of blower, allowing great facility to the fire draft. On account of its heavy construction, it offers ample resistance to the pressure. It is claimed that it is not affected by immediate contact with the fire, and that capillary action is completely suppressed.

By this apparatus an absolutely new departure is brought about in the generating of steam, and it is contended that its application will be of incalculable value, either as a motor agent or in the employment of steam dried at hitherto unknown temperatures. Either coal, coke or petroleum may be used for fuel.

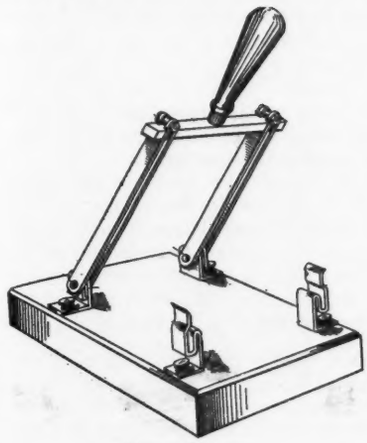
National Physical Laboratory.

Dr. Glazebrook, who is in charge of the National Physical Laboratory, in England, has given out the following information regarding this laboratory. He hopes that it will be opened for work by the end of the year. An engineering laboratory 80 feet long by 50 feet wide has been constructed, and provided with a traveling crane and lines of shafting from which experimental machines can be worked. Adjoining this is the drawing office, while the engine room and the boiler room are at the end. The electrical power required will be obtained from a 60-kilowatt Parsons steam turbo-dynamo, which has been selected to avoid any vibration. Among the work which Dr. Glazebrook proposes to commence immediately the laboratory is opened is the continuation of the researches on alloys inaugurated by the Institution of Mechanical Engineers; also a large series of experiments will be carried out on the examination of steel and iron by means of micro-photometric methods. The apparatus to be installed will also enable them to make experiments on the elasticity of the alloys above referred to. A complete set of apparatus is being arranged for the standardization of pressure gauges and steam engine indicators. A certain amount of attention has also been paid to the provision of the requisite plant for the carrying out of research on high-temperature thermometers. All classes of electrical apparatus can be tried in these new laboratories, which will be of great service to the electrical profession. Dr. T. E. Stanton has been appointed superintendent of the engineering department.

FIG. 10.—COIL INSULATING DEPARTMENT, STANLEY ELECTRIC WORKS.—(See page 542.)

Electrical Patents

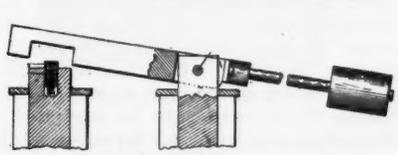
It seems as if the knife switch must have reached its simplest construction in the patent recently granted to Mr. Montgomery H. Johnson, of Utica, N. Y. The knife plates are each double, being formed



KNIFE SWITCH.

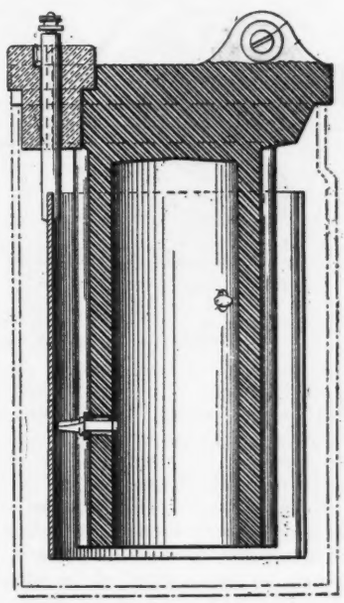
by sheet metal strips bent parallel, the bent portions being bifurcated to receive the cross-bar of the handle, bolts connecting the ears formed by the bifurcations and holding said cross-bar in place. The terminals to which the plates are pivoted are formed of sheet metal, the upstanding portions being doubled. Bolts or rivets form the pivots and pass through these doubled portions which are embraced by the sections of the plates, so that springs are formed which prevent any looseness at the joints. The other contact pieces or terminals are substantially S-shaped, having inset terminals that form guides for the plates which embrace their lower portions, and, because of their yielding structure, ensure a good contact.

A new electromagnet has been patented by Theodore H. Wumb and Robert Baumann, of St. Louis, Mo., the object being to provide a device which is economical in the use of electric current and is positive



NOVEL ELECTROMAGNET.

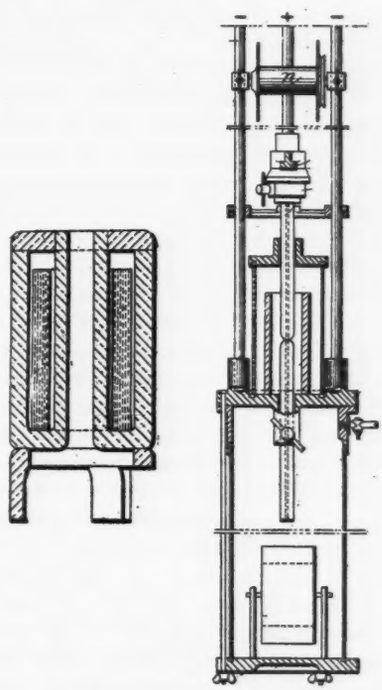
in action. By referring to the accompanying illustration it will be seen that two magnets are provided, one of which carries the armature which operates upon the other. The core of the former is therefore extended above the body of the magnet, and the armature is bifurcated to receive it. Extending rearwardly from this bifurcated portion is a rod upon which is adjustably secured a counterweight that is arranged to overbalance the weight of the armature and hold it in a raised position. Within the upper extremity of the other core is formed a depression in which is located a spring that supports a cap or pin, the purpose of which is to receive the impact of the armature when drawn downwardly by magnetic attraction, and also to counteract the effect of the residual current. This pin or cap, when depressed by the closing of the armature, projects above the core just enough to prevent actual contact between the armature and the pole. It will therefore be apparent that this arrangement of electromagnets reduces the air-gap to a minimum throughout the entire motion of the armature, resulting in the highest possible efficiency in the attractive power.



ELECTRIC BATTERY.

The Eastern Carbon Works, of Rahway, N. J., has obtained control of a patent on a decided novelty in the way of electric batteries, the inventor of which is Mr. William Mills, of Elizabeth, N. J. The invention is particularly designed for voltaic cells which have a central carbon element more or less completely surrounded by a zinc sleeve. In such a cell it has been heretofore attempted to prevent accidental contact by surrounding the carbon with a heavy elastic band of rubber. This had many advantages. The rubber covered a material amount of the carbon surface; it formed a shelf on which salts deposited, which covered a considerably additional area of the carbon and, moreover, in time accumulated to make a short-circuit between the carbon and zinc; and the action of the exciting fluid caused the rubber to lose its tensile force quickly, whereby it dropped off the carbon. In order to subject a large surface of the carbon element to the exciting solution, it is desirable to flute the exterior surface of carbon electrode, but this fluting still further reduces the hold which this rubber band can have on the carbon. The invention obviates all the above-mentioned difficulties by providing insulating pins between the two electrodes adapted to prevent their contact, and the invention consists, broadly, of pins so employed. In carrying out the invention it has been found advantageous to secure the pins to the carbon electrode removably, and the invention comprehends also this feature.

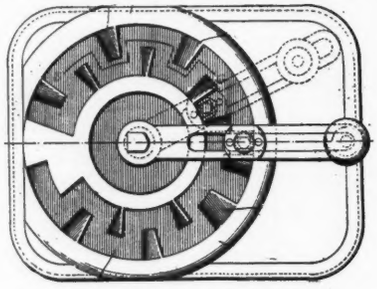
Mr. William L. Voelker, of London, England, has just obtained a patent on a novel method or process for manufacturing carbide filaments from threads or fibres of carbonizable material capable of absorbing or otherwise taking up the salt



MANUFACTURE OF FILAMENTS.

of the metal—such as uranium, titanium, zirconium or beryllium—which is to be combined with the carbon in the formation of the carbide. In carrying out the improved process any kind of homogeneous fibre capable of being converted into carbon by the aid of heat may be employed, as, for example, a long-fibre cotton thread or a filament formed by forcing cellulose while in a viscous condition through a die. The thread or filament having been rendered chemically clean in any of the ways

known to chemists is soaked in a solution of the salt or salts of the metal or metals intended to form the metallic base of the carbide. The salt or salts should be of readily decomposable kind, such as the acetate or cyanide. After soaking, the thread or filament is well dried and then spooled. Where the salt has been prepared with a mineral acid and acts deleteriously on the carbon at a high temperature, the thread or filament should be ammoniated in order to convert the salt into an oxide. The spooling of the thread or filament may be conveniently effected on a cylinder of paper, a strip of thin rice paper being interposed between each layer as it is wound on. The required quantity having been wound, the spool is placed in an oven and well dried at a temperature which will not char the thread or filament. The spool is then placed in a crucible and well packed with powdered sugar-carbon and with powdered carbide of the kind to be produced. The spool is arranged in the crucible upon a hollow core formed integral with the crucible. The object of the hollow core is to ensure a proper distribution of the heat about the spool and to prevent unequal shrinkage of the filament, the crucible being placed upon a kind of grid with a view to facilitating access of the heated gases to the central duct formed by the hollow core. The crucible having been carefully sealed by means of the cover is then placed in a suitable furnace—such, for instance, as an "American gas furnace" or a Siemens regenerative furnace—and the temperature gradually raised to an intense white heat, with the effect that the filamentous foundation becomes carbonized and the metallic salts converted into oxides. The furnace having been allowed to cool slowly and the spool removed therefrom, the end of the carbonized thread or filament is next passed through two longitudinally perforated carbon electrodes, mounted axially in line with one another and capable of being moved apart, or several carbon pencils may be arranged about a central passage through which the filament is led, the carbons being connected in such a manner as to produce a multiple arc. The space to be occupied by the arc is in either case immediately surrounded by a cylinder, composed of the metal intended to form the metallic base of the carbide or composed of the carbide itself, this cylinder being in turn enclosed within a tight-fitting globe or vessel, formed of glass or of the same substance as the cylinder. A small electric arc is struck between the extremities of the carbons so as to produce a high-heating effect without much pressure, the globe or vessel being meanwhile charged with hydrogen or carbureted hydrogen or with vapor of a hydrocarbon or of the metal intended to form the metallic base of the carbide. The spool is preferably mounted in a gas-tight container, to which the hydrogen or other gas is admitted by way of a cock, the said gas passing from the container through the perforation in the carbon into the interior of the cylinder and globe or vessel. The extremity of the carbonized thread or filament having been passed through the carbon electrodes and carried to a drum or reel, the thread or filament is drawn through the electric arc at a speed depending upon the strength of the current. The carbide resulting has a metallic appearance, and although of a highly crystalline nature may, when cut into the required lengths, be readily bent into horseshoe form and mounted in



TIME-ELEMENT CONTROLLER.

incandescing lamp globes in the ordinary manner. The temperature which should be employed at the final stage of converting the filament into carbide will vary slightly when working with different kinds of metals. The temperature appropriate may, however, be determined by that at which incipient fusion of the metallic oxides takes place. The function of the cylinder is twofold—first, to retain the heat generated by the electric arc, and, secondly, by vaporization of the substance of the cylinder to furnish the metal to be combined with the carbon of the filament in the formation of the carbide. The hydrogen or other gas admitted into this cylinder becomes charged with the vapor of the metal composing the cylinder, the latter being thus conveyed to the carbon of the filament and combining therewith forms, under the influence of the intense heat of the electric arc, a carbide. The gases mentioned may, so far as regards their mechanical functions, be considered as equivalents. The gas serves in every case to displace oxygen and at the same time to convey the base metal in the form of vapor to the carbon of the filament. This function prevails whether the metalliferous vapor be supplied as such or whether it be obtained by vaporizing the surrounding cylinder. From a chemical point of view, however, the several classes of gases mentioned can not be regarded as equivalents. It is well known that hydrogen is a powerful reducing agent. It is also well known that hydrocarbon gas or vapor, when subjected to a high temperature, becomes decomposed into its constituent elements, the hydrogen reducing the oxide in the filament and the carbon uniting with the metal of the cylinder and of the filament. Such a chemical action is advantageous; but it is not essential to the carrying out of the invention, while the mechanical functions of the gaseous medium are essential. The carbons may be mounted in a similar manner to those in an ordinary electric arc lamp and their regulation effected by suitable mechanisms or by hand. In the accompanying illustration the carbon is held in a socket carried by a transverse bar, the latter being supported by rods, while the carbon is carried by the plate in which the supporting rods terminate. The method of manufacture hereinbefore described is well adapted for use in the production of incandescing lamp filaments, where uranium, titanium, zirconium or beryllium, either singly or in combination, or in combination with other metals, is employed as the metallic base of the carbide.

Mr. George W. Schilling, of Philadelphia, Pa., has patented a controller for electrical apparatus which has for its object to provide means applied to electrical apparatus for preventing the operator thereof from too rapidly applying the current or voltage. The cap or lid of the casing of an electrical controller is provided with two concentric flanges, forming an annular channel, shoulders project inwardly from the inner faces of the flanges and alternate one with the other, forming a circuitous or zigzag passage in the channel. The lever or handle of the controller consists of separable parts which are fitted to each other telescopically, one of which slides on the other. A plunger has a stem movably fitted in the inner end of the sliding section of the lever extending in a vertical direction and being pressed downwardly by a spring within a box or guide on the sliding section which contains the stem. The upper faces of the shoulders on the cap are inclined or slanted, and the sides of said shoulders are right-lined. It will now be seen that when the current is to be turned on, the lever, which is at rest at the no-load point, is moved, say, to the right. Then the plunger meets an obstacle in the shoulder which intercepts its path of motion. Therefore, in order to pass the same the sliding handle-section of the lever is moved in so as to clear said shoulder, and the motion is continued when the adjacent shoulder presents a further obstacle, in which case the handle-section is drawn out, and so on, by which means the current may be regulated to the extent required, and provision is also made for preventing the lever from being abruptly moved to the full current or voltage point. In order to reduce the current, the lever is returned in the direction of its starting point, when the plunger may ride over the inclined faces of the shoulders, the plunger readily yielding, owing to the action of the spring. It is evident that the lever may be moved in the opposite direction for reversing the current.

A Novel Direct-Current Meter.

The Halsey meter, which has just made its appearance on the market, is very compact being only 8½ inches high, 5¾ inches in width and 4¾ inches deep. In the larger sizes the length is slightly increased, also the weight, which is about 12½ pounds. It is notable for simplicity

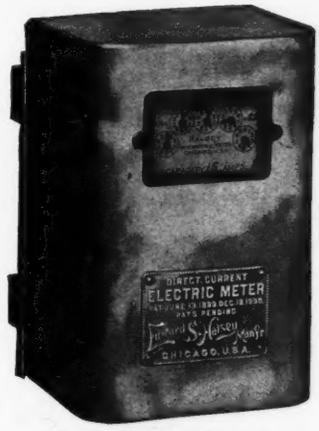


FIG. 1.—METER COMPLETE.

and it is claimed for the meter that it is exceptionally accurate and durable. Fig. 1 shows the meter complete, with its aluminum cover, and in Fig. 2 the cover is removed, showing the shaft and mercury receptacle aperture locked for transportation. This meter consists, briefly, of the following principal parts: The powerful permanent magnet shown in Fig. 4, the solid amalgamated copper disc armature shown in Fig. 3 and the con-

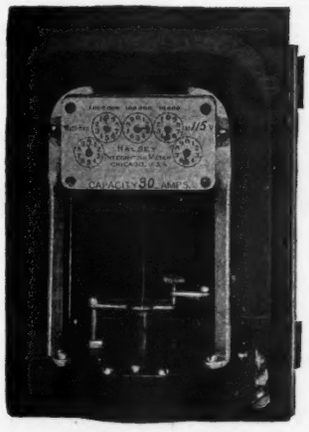


FIG. 2.—METER WITH CASE REMOVED.

taining receptacle for the armature and the mercury in which it is submerged, the top portion of which receptacle is a thick disc of insulating material with a round soft iron pole-piece and two copper electrodes passing down through it to the mercury bath, as is shown (with the aluminum frame) in Fig. 3. The bottom of the receptacle is a disc-like iron casting which is shown with the magnet and the ring washer which defines the chamber in Fig. 4. The solid copper disc armature is made to revolve by the measured current, which is led to it so as to traverse it radially through a powerful concentrated field by the two lead wires passing through the top of the receptacle to the mercury. A greater and a definite part of this current passes through the copper disc, as its conductivity is nearly a hundred times greater. It is obvious that this current will develop in the copper disc a torque and velocity in direct proportion to the amount of current, as the disc is retarded by Foucault currents generated in it by the strong concentrated field. The disc's movement is communicated directly to the integrating mechanism through the medium of the shaft, thus making a direct-cur-

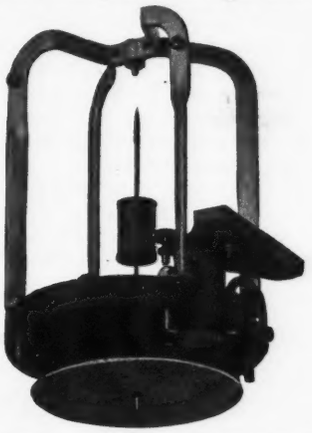


FIG. 3.—COPPER DISC ARMATURE.

rent meter without complication or delicate parts. As copper has a specific gravity less than that of mercury, it has a tendency to float and, absolutely to compensate for the excess buoyancy, the small circular weight is fixed around the shaft, with a soft rubber gasket cemented to its under side, the rubber fitting the shaft sufficiently tight to support the weight upon the shaft at any point. Another object of the rubber gasket and weight is the sealing of the small central opening in the containing receptacle mercury-tight, which is accomplished by simply depressing the weight on the shaft by the fingers into its socket in the top of the receptacle, and by swinging the cross-bar from the left side across the top of the weight so as to come beneath the thumb-screw at the right side, by which screw the weight is held down in place and the gasket compressed, making the receptacle mercury-tight and locking the armature and shaft in place ready for shipment. This shaft, though quite slender, is of spring steel so that it can not easily become permanently bent. On account of the mercury flotation there is no pressure on the bearings at the ends of the shaft; the whole revolving part is poised on its point bearings, which keep it concentric, saving the expense of replacing worn and injured jewels and the losses resulting from friction and flattened shaft ends. The worm for this shaft is made from an alloy that can not rust and cause friction and is detachable from the shaft.

FIG. 4.—PERMANENT MAGNET.

The meter contains from five to six ounces only of common commercial mercury, which dissolves a trace of copper from the disc and becomes saturated at once, a scum forming on the surface immediately, which protects the mercury against further oxidation or sloughing. The magnet is screwed to the thick insulating backboard and the body is fastened to the magnet by four screws passing up from below into holes tapped into its ends. The outside connections are conveniently brought in at the side, where they are most easily inspected, and pass directly into the binding-posts, which are sunk into the insulating board so as to get them out of the way and make the entrances dustproof.

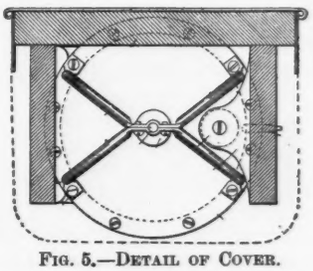


FIG. 5.—DETAIL OF COVER.

The interior leads pass from the posts to the two external ends of the electrodes from the mercury bath, where the junction is accomplished by the flattened ends being first thoroughly amalgamated and then clamped together by screws, their own spring being sufficient always to keep contact firm and the amalgamation guaranteeing constancy of conductivity. All meters except the fifteen-ampere size, which is the

smallest made, and all three-wire meters, are made with a heavy low-resistance shunt of proper temperature coefficient across the armature circuit. The cover is made of aluminum, left in its natural finish, which gives it an attractive appearance that is everlasting, while it is readily cleaned. This cover is of two parts; an idea of it may be had from Fig. 5, the back portion being permanently fixed between the insulating board and the two wooden cleats. The two edges of this back sheet are curled forward, forming spring rolls that clamp the edges of the detachable portion or cover proper when it is pushed back between them and the edge of the backboard. The cover proper engages the back portion by overhanging one quarter of an inch and is engaged at the bottom by a spring bolt that snaps into place when the cover is pushed back. The speed of the meter may be changed by turning a pointer on the bottom of the mercury chamber which cuts off or reduces the Foucault drag. Mr. Halsey states that he is preparing a disappearing-figure dial, which will probably be ready in a few months, which is adapted to be interchangeable with the present pointer form. It will be differential, always running in a forward direction regardless of the direction of tl e rotation of the armature, as is covered by one of his recent patents. The main difference between the two and three-wire meter is in the shunt and calibration and in the three-wire meter being provided with a neutral binding-post at the side of the shunt. The three-wire meters are connected into circuit after the manner shown in Fig. 6. The magnet in this meter is a steel casting of a certain analysis and treated by a special process of the inventor's own development, the results of extensive experiment extending a number of years and by which he states he is able to make a magnet of unusual strength and permanency so that it will maintain its full strength as long as it is incorporated in the meter. Mr. Halsey has had one of his earlier forms of meter in operation for over three years without any sign of depreciation of any sort and several others for a considerable length of time. It is an interesting fact that the shunting or reducing of the lines of force does not affect the speed of revolution to any extent, as the same field produces both the torque and the Foucault brake for the meter. These meters are calibrated to read directly in watt-hours for constant-potential circuit from 100 to 250 volts, and as amperemeters for series arc lights, storage batteries and power circuits. The fifteen-ampere is the smallest size that will be built, as all sizes will run on a very small fraction of the rated capacity, often on less than one-eighth of one per cent. A fifteen-ampere meter will run between twenty-five and thirty per cent slow on one-tenth of an ampere, five or six per cent slow on one-half ampere, one and one-half per cent slow on one ampere, continuing to rise till correct at two amperes, and will register with certainty on the one-candle-

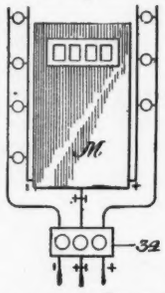


FIG. 6.—CONNECTIONS OF THREE-WIRE METER

power filament of the Hylo lamp, which is the smallest commercial load existent. Mr. Halsey has developed several other forms of this meter which he has patented, notably a meter with a cylinder armature and one with two fields in which the current traverses the full diameter of the disc. He has also secured foreign patents in the principal countries.

It is a fact worthy of note that this device is a direct-current meter of the rotary motor type, without commutator or brushes and without one single turn of wire.

FIG. 1.—AUTOMATIC DOOR SWITCH COMPLETE.

FIG. 2.—FACE-PLATE REMOVED, SWITCH OFF.

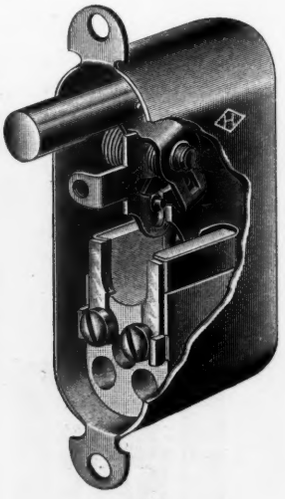


FIG. 3.—SWITCH ON.

Automatic Door Switch.

The convenience of having lights in clothes closets and similar places, which are entered only occasionally, and the economy of having such lights burning only when needed, have led to the use of door switches, which are automatically operated as the closet door is opened and closed. The service under such conditions is more severe than in the case of switches operated by hand, and which are rarely used more than a very limited number of times per day. The construction of the door switch must therefore be of the best. The switch must have a positive snap action, be particularly durable, and so designed as to reduce the labor of installation to a minimum.

The automatic door switch, illustrated in Figs. 1, 2 and 3, known as the Diamond H type, is enclosed in a steel case with semi-circular ends. This form of case facilitates letting the switch into the door jamb, as, after three one-inch holes are bored, it is only necessary to cut out the wood between them to admit the case, and it is not necessary to square up the ends of the oblong opening.

The insulation of the current-carrying parts from the mechanism is effected by the use of sheet mica. The spring bronze contacts are carried by a porcelain block, which is screwed to the bottom of the case, and extends through the bottom at the end where the wires enter. The binding screws on the face of this block are accessible from the front. The parts of the switch most subjected to wear are made of nickled steel. The springs are of the best music wire, nickled, and are helical in form and of large diameter.

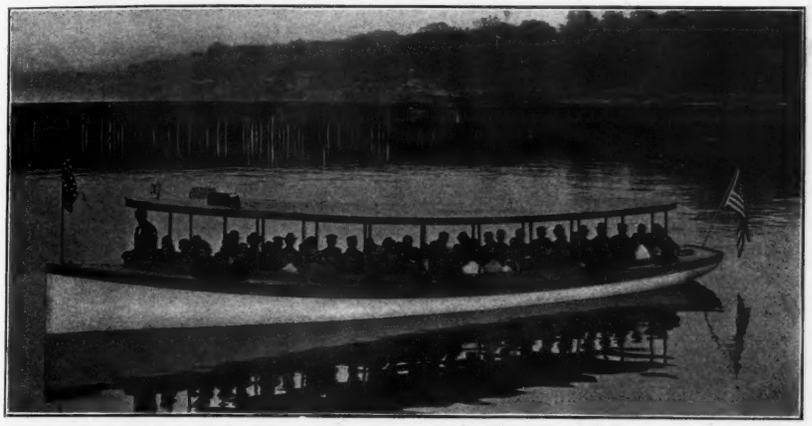
The action of the switch is smooth and easy. The break is one and one-quarter inches in length, and is sufficient for three amperes at 250 volts. A steel template is furnished, which, when placed against the door jamb and tapped with a hammer, gives the location of the centres of the two screw holes at the ends of the face-plate, and also of the three one-inch holes to be bored for the case. It also gives the outline of the face-plate.

These switches have been given tests equivalent to years of actual service, and of all the switches so tested, it is said that not one has given out or shown the slightest weakness in any respect. The switch is manufactured by the Hart Manufacturing Company, of Hartford, Ct.

Mr. Gerald W. Hart, president of the company, believes that in presenting this "Diamond H" switch to the trade, he is offering something which will meet the most exacting requirements.

A Forty-Two-Foot Electric Launch.

The electric launch illustrated on this page was built to be used in passenger service and for the Omaha & Council Bluffs Railway and Bridge Company, Council Bluffs, Iowa.



A Forty-Two-Foot Electric Launch.

The electric power machinery, consisting of motor and storage batteries, is all placed beneath the flooring, thus allowing the entire boat space to be used for seating accommodations, which, as may be seen from the photograph, practically occupy the whole boat space from stem to stern.

In service the launch can seat sixty-nine adults, not including the pilot, who is at the bow and from which position he both controls the power and steering of the boat. With a water-proof roof and canvas storm-curtains, adjustable in rainy weather, this type of launch is serviceable at all times. It is operated by a controller of the familiar trolley car type, except that in moving the lever to the right from centre point the boat is propelled forward; moving the lever to the left causes the motor and propeller to be reversed, so that the boat can be easily stopped in a short distance.

This particular boat established a record in boat-building, for it was entirely constructed, equipped and loaded for shipment in twenty-nine days after receiving the order, having been built by the Electric Launch Company, of Bayonne City, N. J.

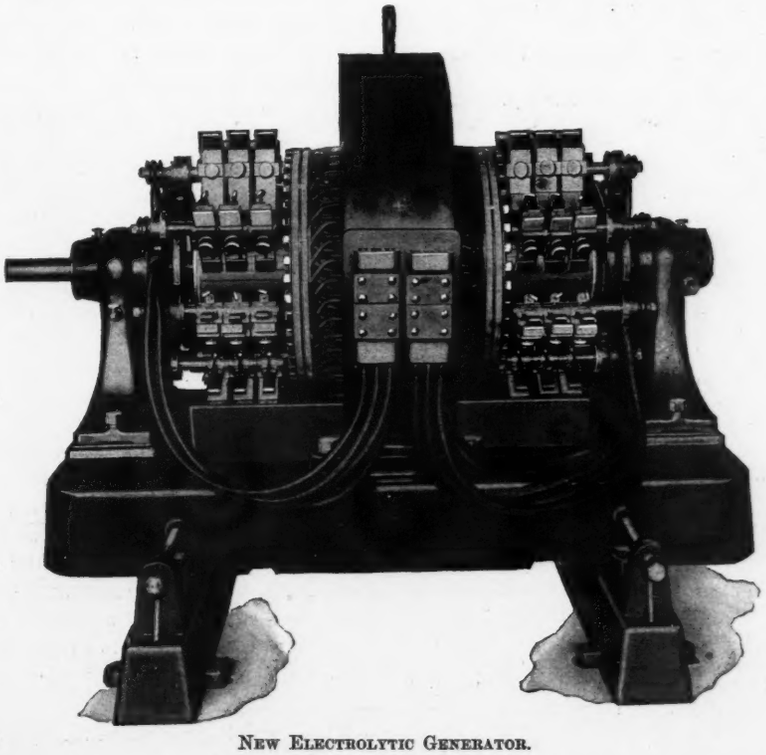
As electric launches have proven excellent auxiliary feeders to trolley railway systems, various types and designs are constructed, all of which embody methods in construction which will allow of the most rapid exchange of passengers at any landing, the boat in the illustration having two entrances, one forward and one aft, where the side structure of the boat hinges open to enable passengers to step in and step out of the boat, instead of climbing over the boat coaming, as is the usual practice.

The Omaha Railway Company has had the most satisfactory results from the operation of the boat, the cost of recharging the batteries with their trolley line current being practically inappreciable, the only element of cost in operating the boat being the services of one pilot.

A Special Electrolytic Generator.

In many of the mining communities of the world electrolytic action is used with great success in the refinement or reduction of metals. For this purpose an electric generator of rather low voltage and large current strength is required. With this end in view the Holtzer-Cabot Electric Company, of Boston, Mass., has designed some large generators especially for this class of work. In the illustration a generator with a capacity of 3,000 amperes and an electro-motive force of from four to eight volts is shown. This machine is one of two which were built a short time ago for the Imperial Ore Reduction Company, of Boston. It is to be used for refining copper at the mines in El Paso, Tex.

Two problems present themselves in designing machines for this purpose. In the first case it is necessary, as far as possible, to prevent abnormal losses from the heating effects of the current, or the C^2R losses, as they are designated in the equation. The second is the necessity to commutate a very large current of this kind. The first of these problems has been solved in this machine by careful attention to ventilation and large allowances of copper and iron. To overcome the second difficulty a double armature winding with two commutators and a special arrangement of the field have been employed. Cast iron is used for the field ring, and the poles—which are eight in number—are constructed of wrought iron, cast welded into the ring by which an excellent form of magnetic joint is made. A special form of shoe of cast iron is fitted to the poles, which is selected on account of its low permeability at the normal in-



New Electrolytic Generator.

duction of the field. This is saturated and assists in preventing the field flux from becoming distorted by cross magnetization in the armature. The core of the armature is of rather large diameter. It is built up of thin discs of soft steel, which are painted on either side for the purpose of breaking up the eddy currents. This core is mounted upon a spider, the laminations being clamped in a special manner by end-plates which does away with bolts running lengthwise through the body of the core, thus preventing local currents and reducing magnetic hysteresis. A threading projection is attached to the spider for holding the commutator in such a way as to leave an opening between the shaft and the commutator in front. In the core, air ducts are provided and the air is drawn into the body of the core and then out centrifugally through the ducts and windings which are to serve to keep the armature cool in spite of the great quantity of current flowing. For this purpose the cylindrical form of winding is employed, which makes the armature resistance low and permits of the replacing of a damaged coil without much difficulty. Bar copper is used for the coils entirely without joint save where they are soldered to the risers of the commutator.

The commutators are very large. Hard rolled copper segments are used for them, with soft mica insulation. They are clamped by bolts in such a way as to prevent entirely shifting of the segments. The section of the copper segments was made very large to get rid of the heat which was generated by the flow of the current and the friction of the brushes. At the same time plenty of wear was allowed for.

For this purpose of carrying a heavy current the brush-holder was designed especially. This brush-holder is of the tangent type and clamps the brush with a thumb-screw. A continuous metallic circuit extends from the portion of the holder that carries the brush to the part clamping the stud. In this manner there are no movable or sliding contacts to be depended upon for carrying the current.

The machines are excited separately at 110 volts. They are able to deliver from 0 to 3,000 amperes of current owing to the special shape of the pole shoes without its being necessary to change the position of the brushes, the diameter of commutation remaining practically fixed for these ranges of load. These machines are designed to be belted and to run at a speed of 450 revolutions per minute. This speed is made low purposely to do away with as much of the friction loss as possible, and also to keep the brushes from cutting the commutator, which difficulty is frequently met in high-speed machines of this type. The outputs of the two halves of the armature are delivered in parallel to the terminal blocks at the full voltage of the machine. It is intended to connect these machines in such a manner that they may work separately or in multiple and give an output of 6,000 amperes at an electromotive force ranging from four to eight volts.

A Four-Party Line Selective Telephone Signaling System.

The selective signaling system which is now being placed on the market by the Metropolitan Telephone and Electric Company, of Chicago, Ill., is the invention of Mr. Oscar M. Leich, general manager of the above company. The demand for such service has been a continually growing one and nearly all switchboards that are now being installed are equipped with four-way ringing keys.

The main features of the Leich party line are that the bells have condensers to prevent the battery loss and that the signaling is done entirely without any spring adjustment or relays.

After one instrument is installed and connected to a four-party line, the other three instruments may be added to the line without disturbing any of the subscribers already connected to that line.

As neither line resistance, inductance nor capacity, as met with in practice, has any influence upon the successful operation of this system, it has proven very satisfactory for cable work and can also be used on long-distance toll lines. This system will also be found very useful for small exchanges, where it is necessary to put eight parties on one line, giving one and two rings. For small exchanges of this kind Warner pole changers may be employed for operating the system.

As alternating currents only are employed in the operation of the bells, the four-way ringing keys are wired in such a manner that alternating currents can be sent from either side of line to ground. This permits the same four-way ringing keys to be used for ringing two-party lines, using ordinary polarized bells bridged from either side to the ground.

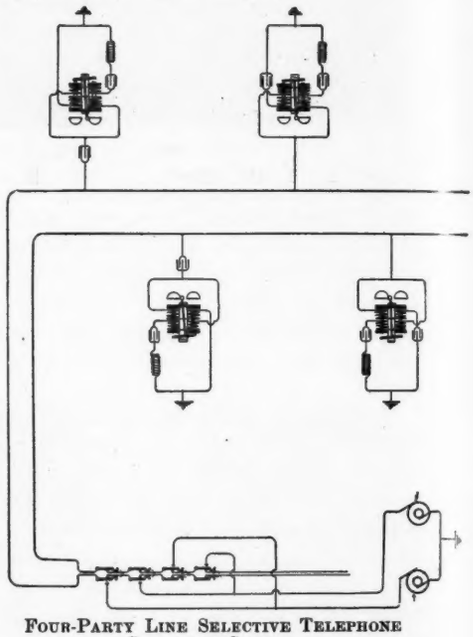
The great flexibility of this system, due to the exclusive use of alternating currents, thus adapts it to a variety of different uses, all of which are, as is well understood, incidental to the operation of a well-managed exchange in which it is desirable to give two-party as well as four-party line service. The alternating current of the two frequencies—sixteen and twenty-six—which are preferably employed, are both adapted to cause a satisfactory ring of any ordinary type of polarized bell.

The principle upon which this system is based depends upon the great change of impedance offered to the flow of an alternating current by a condenser and an impedance coil in series, when the frequency is altered, and also upon the phase relation of the currents in the differential windings of the bells.

This large variation of impedance and change of phase relation precludes the possibility of the device being at all marginal.

Due to the relative change of impedance in the differential windings the distribution of current therethrough may be varied by changing the frequency, making it possible to cause a bell to operate or remain silent on any desired frequency.

This method of operating bells selectively is distinct from the well-known harmonic system and all other systems; it is covered by patents owned and controlled by the above-named company.



FOUR-PARTY LINE SELECTIVE TELEPHONE SIGNALING SYSTEM.

Fig. 1 shows diagrammatically a metallic line associated with four selective bells and a four-way ringing key, the cord circuit and the subscriber's talking sets being omitted for the sake of simplicity. The first bell on each side of the line is adapted to ring when a current of low frequency (sixteen cycles) is sent over that line, and the second bell when a current of a higher frequency (twenty-six cycles per second) is used.

One of the low-frequency ringer windings is in circuit with a condenser and an inductance coil which are so proportioned that they will neutralize at a frequency of twenty-six cycles per second. A high-frequency current will divide equally through both of the windings of the low-frequency bell and not ring it; but a low-frequency current is stopped by the high impedance offered thereto by the condenser in circuit of one of the windings so that the greater portion of the current will flow through the remaining winding and thus operate the low-frequency bell.

In the high-frequency bell one winding of the two differential windings is again included in circuit, with a condenser and an inductance coil, proportioned to neutralize at the high frequency (twenty-six cycles per second), while the other winding is included in circuit with a condenser. As the impedance offered by the condensers which are in circuit with the two windings of the high-frequency bell to the flow of the low-frequency current is very great, this low-frequency current will divide equally through both windings and not operate the bell, as the impedance of the inductance coil is very small at this frequency (sixteen cycles per second). The high-frequency current will flow readily through the winding included in circuit with the condenser, and the inductance coil as the capacity and inductance neutralize on this frequency; the flow of this current through the other winding is greatly impeded, however, by the condenser in circuit therewith, so that this high-frequency current divides through the two windings with sufficient inequality to operate the bell.

The Cape Nome–St. Michaels Cable Working Well.

The Kerite cable laid between Cape Nome and St. Michaels last year is now in perfect working order and has been in constant operation since August 20. This cable, which was 132 miles in length, being the largest cable made and laid by any American manufacturer, was laid between Cape Nome and St. Michaels. Advices direct from St. Michaels state that the cable is giving great satisfaction and that it is proving a paying investment.

The cable was manufactured in the Seymour, Ct., factory of W. R. Brixey, and its laying was deemed by experts a difficult accomplishment in view of the physical conditions of the bed of the water through which it was carried, the heavy ice and the rigor of the climate. As it was reported from time to time that this cable was badly damaged by ice and not working its success is of interest.

The steamer Orizaba, carrying the cable, was wrecked off St. Michaels Island in September of last year, and the cable was removed from the steamer. This accident has been the cause of a delay in its final laying and operation.

By mixing the following ingredients a lining for acid troughs can be made: One part resin, one part pitch, and one part plaster of paris.

A New Hand Telephone.

The telephone which is shown in the illustration is very convenient, simple and neat, especially for desk use, and is well suited for exchange or long-distance use. In order to ring up central or the connecting telephone it is necessary simply to lower the hand telephone. In taking hold of the hand telephone to place the receiver to the ear, the hand presses in a small lever which cuts out the ringing circuit and puts in the conducting circuit. When the receiver is placed at the ear the transmitter is at the right distance from the mouth.

HANGING TELEPHONE.

The handle is so made that the cord may be taken out of either the transmitter or receiver end. The connections are easily made. No screws are left exposed so that contacts may be made with the hand. This telephone makes a complete desk set without a magneto.

All the electrical connections are put together by simply screwing them in. The parts are interchangeable, and being completely sealed at the back the instrument is said to be proof against moisture. The back electrode is formed by gold gauze in a convolute spring shape and the front electrode of a specially prepared gold-plated spring metal diaphragm, the only carbon used being the granules between the electrodes, these being placed where they are sealed in from the effect of the moisture of the atmosphere.

The receiver is of the bipolar type, the permanent magnets being bent from bar steel. The electromagnets are permanently fixed and held in place by a stamping of brass which fits inside the case and allows only the terminals of the soft iron cores to project. The cord is of a very flexible grade and an arrangement is provided in the magneto box to take it up at that end if too long for a low ceiling.

The magneto box is so designed as to make all parts contained therein easily accessible by simply unclasping and lowering the jacket. All the parts are exposed, which makes any necessary repairs easy without taking the telephone apart.

The induction coils have hard fibre ends with terminal screws, which facilitates the changing of the coils in case of burnouts. In putting up the instrument all that is necessary is to connect the main lines and the battery wires. In this telephone the receiver hook is done away with, also gravity and spring contacts. The telephone is manufactured by the Vought-Berger Company, of La Crosse, Wis.

Convention of Automobile Manufacturers.

The first annual convention of the National Association of Automobile Manufacturers for the discussion of trade topics will be held in the assembly room of the Madison Square Garden during the week of the automobile show, on the forenoons of Tuesday and Wednesday, November 5 and 6, from ten to twelve o'clock. Although many prominent manufacturers have brought their vehicles to a practical state of efficiency, yet the industry is so comparatively new that the addresses and discussions can not fail to be most instructive and helpful.

The annual meeting of the association for the election of executive committeemen will be held in the same place at 8.30 P. M., on Thursday, November 7, upon the termination of which there will be a dinner and speeches. It is hoped to be able to secure for this event ex-President Eddy, of the Chicago Automobile Club, who made a speech at the dinner last year.

The New York Electrical Society.

The 217th meeting of the New York Electrical Society was held Wednesday evening, October 30, at 8 P. M., at the College of the City of New York. Mr. F. W. Willcox delivered a lecture on the "Manufacture and Use of the Modern Incandescent Lamp," which was elaborately illustrated with lantern slides. Mr. Willcox also treated on the uses of the lamp and the part it plays in present day illumination.

Mr. Luther Stieringer also delivered a brief address on the "Incandescent Lighting at the Pan-American Exposition."

Astonishing Reform in Great Britain.

In our esteemed namesake, published in London, this advertisement appears:

THE POSTMASTER-GENERAL has 40 tons of Gutta-Percha, 100 tons of Old Copper Wire, Plates, &c., also various other Wires, Batteries, and A LARGE QUANTITY OF RED TAPE FOR SALE.

This portends a sweeping reform, especially if all the red tape hitherto in use is to be sold. The opportunity for some patriotic Briton to buy it all in before the London County Council gets hold of it is one that should be seized with avidity.

The American Institute of Electrical Engineers.

The 157th meeting of the Institute was held in New York, Friday evening, October 25, the occasion being marked by a very large attendance and the discussion of a general topic—regulation in prime movers and parallel operation of alternators.

The meeting was one of the most interesting that has been held for some time past. It was opened by a general introduction or digest of the subject by President Steinmetz, which was followed by the reading of a paper by Mr. P. O. Keilholtz, of Baltimore, entitled "Angular Variations in Steam Engines." Mr. Keilholtz's paper was a very elaborate discussion of experimental work done upon a large engine to determine the amount and character of its angular variation, in reference to all of the various elements which enter to cause its departure from perfectly steady revolution. The paper was highly analytical and exhibited the results of a very complete and careful study of the subject. This was followed by a paper on the parallel operation of engine-driven alternators by Mr. W. L. R. Emmett, who described conditions he had encountered in practice and an ingenious method of overcoming the "hunting" of alternators by the use of a controlling dash-pot mechanism on the engine governors. A paper by Mr. E. J. Berg, entitled "Parallel Running of Alternators," was presented in the author's absence by President Steinmetz. This paper considered the general theory of parallel operation from a new point of view and developed equations which give the criterions for division of load between two machines working in parallel.

The next paper was by Mr. Walter I. Schlichter and was entitled "Angular Velocity in Steam Engines in Relation to Paralleling of Alternators." Mr. Schlichter dwelt elaborately upon the mathematical side of the question and showed some results that have been obtained with a cross-compound engine wherein the difficulties have been largely overcome.

Mr. R. H. Rice, of Providence, presented a short but very interesting contribution to the discussion, bearing upon the governing of steam engines, which was read by Secretary Pope in the author's absence. Mr. Seymour, of the McIntosh-Seymour Engine Company, presented a very interesting communication on engine governors, and described at some length the apparatus referred to in Mr. Emmett's paper. Mr. Peak spoke concerning the regulation of impulse water-wheels. Mr. C. F. Scott then spoke at some length and pointed out the beautiful analogy existing between engine-driven alternators operating in parallel, and engine-driven machinery of any other kind geared solidly together on a more or less flexible shaft. The discussion was continued by Dr. A. V. Garratt, Messrs. Nash, Lozier, R. D. Mershon and Mailloux.

Electrical Display at the Yale Bicentennial Celebration.

One of the most noteworthy features of the recent Bicentennial Celebration of Yale University was the illumination of the green and surrounding buildings in New Haven. It was one of the most elaborate electrical displays that has ever been attempted in New England.

A large tower was constructed about the shaft of the flagpole near the eastern end of the green, upon which were placed various figures of different colored incandescent lamps, including serpents, squares, stars, etc. Near the top of the tower was a festoon of different colored lights arranged in the form of an umbrella. From its top strings of lights, forming a sort of canopy, extended out to the trees at the corners of the green, where smaller umbrella-shaped figures were erected.

At eight o'clock in the evening the current was turned on slowly by carefully adjusting the resistance and the whole gradually lighted up. Upon the City Hall the word "Welcome" blazed out, and the edges of the building were dotted with many hundred white lights. The effect of the whole was wonderfully beautiful. Across the green the lofty structure of the Phelps memorial gateway was brilliantly lighted with electric lights. Altogether it made a display which has seldom been excelled anywhere.

The royal train which was constructed by the Canadian Pacific Company for the use of the Duke and Duchess of Cornwall and York during their recent tour of Canada is probably the most magnificent product of railroad architecture ever seen in America.

The royal train proper consisted of nine cars, two of these, the York and the Cornwall, were especially for the use of the Duke and Duchess. The armorial bearings of the Duke of Cornwall and York adorned the outside of the cars. Telephones and call bells permitted of communication from one end of the train to the other.

Two other trains were made up to precede and follow the royal train proper. One of these was for the detectives and other officers who looked after the safety of the party, and the other took along the horses, carriages and heavier baggage.

An Important Decision.

In the suit of the Babcock & Wilcox Company against the Joshua Hendy Machine Works a decree has been entered in the United States Circuit Court for the Northern District of California as follows:

"That a perpetual injunction be and it is hereby issued against the respondent, the Joshua Hendy Machine Works, and its officers, agents, attorneys, servants, clerks and employés, enjoining it and them and each of them from using the name "Babcock & Wilcox" either alone or combined with other word or words upon or in connection with the sale or offering for sale of any boiler or other steam apparatus not manufactured by the complainant and from stating or representing that any boiler or other steam apparatus sold or dealt in by the respondent and not manufactured by complainant is a Babcock & Wilcox boiler, and from selling or offering for sale, or passing off any such boiler or other steam apparatus, as and for boilers or steam apparatus manufactured and sold by complainant."

This decision is in line with others which have recently appeared and shows that the courts have gone far toward acceptance of the equitable view that a concern should be protected from infringement in the use of a name which the public has learned to appreciate for one reason or another. In many cases such a name is looked upon as a designation of the source of manufactured articles rather than as a description of the articles themselves. This tendency on the part of the courts to sustain the right of a concern to the exclusive use of its trade name as a proper designation of its product is one that certainly commends itself to fair-minded people, and the decision referred to established a precedent that is not without importance to manufacturers in general.

The Bremen.

The North German Lloyd Steamship Company gave a dinner on Friday evening, October 26, to a number of its friends on its twin-screw steamship Bremen, to celebrate her return to Hoboken. Addresses were made by Mr. Frank Presbrey, representing the North German Lloyd Steamship Company; Captain Nietrich; Dr. J. H. Canfield, of Columbia University; Mr. Louis Wiley, of the *New York Times;* Mr. Walter Page, of *World's Work;* Mr. Charles W. Price, of the ELECTRICAL REVIEW; Mr. John A. Sleicher, of *Leslie's Weekly,* and Mr. Herbert L. Bridgeman, of the *Standard Union.*

The steamship Bremen was one of the vessels damaged in the great Hoboken dock fire of June 30, 1900, and was almost entirely rebuilt at the yard of the Vulcan Shipbuilding Company, at Stettin, Germany, and is now one of the modern ships of this enterprising transatlantic line.

Current Electrical News

COMMERCIAL NEWS

DOMESTIC AND EXPORT

IN BUCKINGHAM PALACE an electric light plant is being installed. The palace is being refitted throughout.

LARGE CONTRACT AWARDED—The power plant in the new state capital, in St. Paul, Minn., will be installed by W. J. Gray & Company, of Minneapolis. The original bid was for $372,000, but certain deductions have been made.

LARGE ELECTRIC PLANT FOR ST. PETERSBURG—It is reported that the Westinghouse interests are considering the construction of a large plant in St. Petersburg to manufacture electrical machinery, engines, etc., for the Russian market.

PENNSYLVANIA TRACTION MATTERS—The towns of the Chartiers Valley, in Pennsylvania, will soon be connected by the Southern Traction Company. A section of track one and one-half miles long is to be constructed which is to be the connecting link of the loop.

UNDERGROUND RAILWAY IN BUENOS AIRES—According to Argentine advices the Buenos Aires underground railway is to be constructed with United States capital. It is to cost about $8,500,000. It is expected that the line will be completed within three years.

NEW JAPANESE ELECTRIC RAILWAY COMPANY—The Tokio Electric Railway Company is the title of a concern which is now being organized in Japan to construct and operate an electric traction system which is to be built in the important thoroughfares of the Japan capital.

NEW EAST INDIA COMPANY—In London the Calcutta Electric Supply Company has recently been capitalized for the purpose of undertaking electrical work in India. This company is about to issue an additional $250,000 of stock for the purpose of carrying out extensive work in Calcutta.

CABLE RATES—A change in the cable rates to the Yukon has been made by the Dominion Government. The rate has been heretofore $4 for a minimum of ten words; in the future the rate is to be forty cents per word. The press rate, which was formerly $3 for ten words, has been made $1 for ten words.

NEW RAILWAYS IN OKLAHOMA—In El Reno, a company is being formed to build 400 miles of electric lines. The name of the new company is to be the Oklahoma Electric Railway and Light Company. Its capital stock is $1,000,000. Messrs. Fred Ehler, Hennessey, Okla., and T. E. Gillett, El Reno, are among the incorporators.

NEW CANADIAN SUBWAY COMPANY—In Montreal, Quebec, the Dominion Subway Company is seeking incorporation. Colonel C. F. Sise and Robert Archer are among the applicants. The purpose of the company is to construct and maintain underground conduits for wires, cables, etc. The capital stock is to be $100,000.

CUMBERLAND VALLEY TELEPHONE COMPANY—It is stated that arrangements have been made whereby Mr. Charles W. Morse will have control of the new Cumberland Valley Telephone Company, of Pennsylvania. The Cumberland Valley Telephone Company has a capital of $10,000,000 and will, it is said, control many of the subsidiary companies in Pennsylvania.

MR. A. E. WORSWICK, who is the resident manager of the Mexican Tramways Company, Limited, and who has been in New York since his return from Europe, has just returned to the city of Mexico. It is reported that he placed some substantial contracts for the equipment needed for the extension of the company's system to Tuluco while here.

NIAGARA FALLS NEW POWER-HOUSE—Work has been begun by Mosier & Summers, of Buffalo, N. Y., upon the new power-house for the Niagara Falls Power Company, at Niagara Falls, which will cost about $250,000. It is to be located across the street from the present power-house, and will be a duplicate of the present structure. Its length is to be 570 feet and it will have a capacity of 50,000 horse-power.

CANADIAN TELEGRAPH EXTENSIONS—The department has extended the lines which are operated by the Dominion Government in the Gulf of St. Lawrence for the benefit of shipping eastwardly along the north shore of the Gulf from their former terminus at Baie des Moutons to Chateau Bay on the Labrador shore of the Strait of Belle Isle, a distance of about 247 miles. A cable has been laid connecting Chateau Bay with Belle Isle.

ELECTRIC HEADLIGHTS FOR ENGINES—It is said that the contracts for the equipment with electricity for headlights of all the passenger engines of the Chicago & Alton Railway have been let. A small dynamo is to be placed on the top of the engines behind the smokestack to furnish the power. It is claimed that the new headlight will throw a light clear enough to distinguish an object 2,000 feet ahead of the locomotive. The present oil lights do not reach further than 700 feet.

MR. C. S. HOLBROOK, who resigned as president and director of the Massachusetts Telephone and Telegraph Company, and also as vice-president and director of the Boston & New York Telephone and Telegraph Company, has accepted the presidency of the American Electrolytic Company. This company has purchased of the National Salt Company its large plant at Rock Glen, N. Y., and will at once begin the manufacture of caustic soda, bleaching powder and allied products.

NEW ELECTRIC COMPANY ORGANIZED IN TRINIDAD—A group of American and Canadian capitalists has organized the Trinidad Electric Company, Limited, for the purpose of acquiring the Trinidad Electric Light Company and the Belmont Tramways now operating in Port au Spain, Trinidad, British West Indies. This concern is capitalized at $1,500,000. Mr. F. S. Pearson, consulting engineer of the Metropolitan Street Railway Company, New York, is said to be interested in this enterprise.

WIRELESS TELEGRAPHY—Mr. Willis L. Moore, chief of the United States Weather Bureau, has returned to Washington after an inspection of the weather bureau's wireless telegraphy service between Cape Hatteras and Roanoke Island, N. C. Mr. Moore is well satisfied with the result of the bureau's work and has announced that Secretary of Agriculture Wilson has authorized him to extend the service to Cape Henry. The steamship Etruria, of the Cunard Steamship Company, has been equipped with the Marconi system of wireless telegraphy, thus making four steamers which the company has fitted with this system.

ELECTRIC LIGHTING

The erection of an electric light plant for lighting the houses and streets in Oak Grove, Pa., is being agitated by a company there.

At the Christ Church Cathedral in Montreal, Canada, a complete electric light plant is to be installed as the result of a special gift.

A petition asking the Edison Electric Illuminating Company to extend its service to West Roxbury, Mass., has been circulated there.

Good progress is being made upon the electric light plant in Daytona, Fla. Every effort will be made to furnish light early in December.

Superintendent Archibald, of the City Electric Light Works, in Woodstock, Ontario, states that the new plant there will be started up within a short time.

The York Light and Heat Company has agreed to furnish light to the city of Saco, Me., for $82.50 per lamp. The committee has not yet awarded the contract.

Sargent & Company, of Worcester, Mass., have received a contract from the Waldoboro Electric Lighting and Power Company for the installation of an electric power plant in the Achorn Mill on the Medomac River.

A large electric light and power plant is to be erected in Pittsburgh, Pa., by the Keystone Electric Company, which is composed of Braddock capitalists. The Keystone company has a capital of $100,000. Justice Frank T. Redman is its president.

Spokane parties have acquired the electric light and water-power plant in Wallace, Ida., for about $125,000. The new company is the Wallace Light and Water Company. Mr. F. F. Johnson, president of the First National Bank, of Wallace, is the president of the new company.

The Port Jervis Gas Light Company, the Deer Park Electric Light Company and the Port Jervis Electric Light and Power Company, of Port Jervis, N. Y., have been consolidated under the name of the Port Jervis Electric Light, Power and Gas Company. Mr. R. H. Beach is president of the new company.

The new substation of the Youngstown Consolidated Gas, Electric Light and Street Railway Company, in Youngstown, Ohio, has been completed and connected with the main plant. Power for the Sharon, South Sharon & Sharpsville Street Railway, as well as that for the lights, is now furnished from the main plant.

In the United States Court an application for a receiver for the Helena Power and Light Company, of Helena, Mont., on behalf of the Central Trust Company, which holds its bonds for $1,000,000, has been made. Mr. H. L. Walker has been appointed receiver by the court. Mr. Walker is secretary of the company.

A short time ago the village of Frankfort, N. Y., bought the electric light plant in that place which was owned by a company of private individuals. The trustees of the village are now advertising for bids for the construction of a new power-house there. The dimensions of the building are seventy-five by forty feet. It will contain a 200-horse-power boiler and a 150-horse-power Corliss engine. Two dynamos will probably be used for the electrical equipment with the necessary switchboard outfit.

TELEPHONE AND TELEGRAPH

A force of linemen is engaged in rebuilding the telephone line between Brattleboro and Putney, Vt.

Senator H. H. Evans, of Aurora, Ill., is interested in the formation of a new telephone company in Springfield.

Communication has been begun between Bay City, Mich., and Harbor Beach on the new line which the Valley company has been constructing.

Congressman R. F. Broussard has been in New Orleans, La., to make the preliminary arrangements for establishing a new telephone system there.

A contract to build about twenty-five miles of telephone line to connect Florence, Ala., with Rogersville and Oliver has been let to Mr. John A. Pruitt.

The Erie Telephone System has made a net gain of 2,795 subscribers during the month of September, in Boston. Its net gain since January 1 is 13,599 subscribers.

The lines of the Interstate Telephone Company, a branch of the Dubuque Telephone Company, in Dubuque, Iowa, are being extended so as to cover new territory.

The bond of the City & Suburban Telegraph Company for the erection of the telephone system through the village of St. Bernard, Ohio, has been approved and work will be begun at once.

The Phillips Anns Company, of Philadelphia, Pa., is securing estimates from subcontractors for the Inter-State telephone building which is to be erected in Trenton, N. J. It is to be three stories high with a basement.

The Home Telephone Company, of Springfield, Ohio, has purchased a site for a new office. This company is canvassing the city for subscribers, and the work of putting up the wires and equipping the exchange will be begun shortly.

The central office of the Associated Telephone Companies, of Loudoun, has been established in Leesburg, Va., the business having passed into new hands. Telephonic communication has now been established throughout the county.

The Northwestern Telephone Company is extending its line from St. Croix Falls to Centuria, Wis. It is reported that the company intends to extend its telephone lines to the northern towns in the county. This would give the merchants direct communication with Minneapolis and St. Paul.

The stockholders of the Meigs County Telephone Company, of Tennessee, at their annual meeting reelected the old officers of the company, J. M. Abel, president, and J. W. Lillard, secretary and treasurer. A considerable balance in the treasury was appropriated toward extending the lines.

The receiver for the Central Energy Telephone Company, Mr. R. C. Clark, of Frankfort, Ind., has made a contract with the People's Cooperative Telephone Company by which 600 instruments are connected with the Frankfort exchange. Numerous rural telephones in the central and western part of the state are connected by the People's company.

The Inter-State Telephone Company has received a franchise from the Pilesgrove township committee to erect poles and string wires in that township. Arrangements with the New England Telephone Company have been completed by Mr. S. L. Griffith to put in a private line from the railroad station at Arlington, Vt., to the lumber plant of Mr. Griffith on the mountain ten miles from the station.

ELECTRIC RAILWAYS

The Homestead & Mifflin Street Railway Company has received a franchise in Homestead, Pa.

The work on the new power-house for the electric railway in Wheeling, W. Va., has been begun.

The people of Windsor, N. Y., have passed a by-law permitting the South Essex Electric Railway to build its line.

The managers of the Logan Valley and City Passenger Railway companies have decided on an extension of the Logan Valley line to Duncansville, Pa.

A large amount of machinery has arrived in Florence, Col., for the Florence Electric Railway power-house.

The Mandelbaum-Pomeroy Syndicate now controls the Bucyrus & Galion Electric Railway, in Bucyrus, Ohio.

It is expected that the laying of the track for the electric railway between Cumberland and Frostburg will soon be completed.

The county court of Buchanan County, Kan., has granted a franchise to the Kansas City, Parkville & St. Joseph Electric Line.

The officers of the Detroit, Pontiac, Lapeer & Northern Electric Railway are establishing the right of way from Bay City, Mich., to Lapeer.

The Duluth Street Railway Company, operating lines in Duluth, Minn., and Superior, has applied for a license to do business in Wisconsin.

Work upon the construction of the street railway line from Slaterville to Pascoag, R. I., has been begun by the Woonsocket Street Railway Company.

The city council of Little Rock, Ark., has passed an ordinance granting the Little Rock Traction and Electric Company an extension of its franchise for fifty years.

A franchise has been granted to Mr. James F. Rothwell, of Warsaw, Ind., to construct and operate an electric railroad through several townships of Kosciusko County.

The tracks of the Allentown & Coopersburg Electric Railway Company, of Allentown, Pa., have been laid from Lanark to Coopersburg, and the work of ballasting is being pushed.

A charter has been granted the Berwick & Nanticoke Electric Railroad for the construction of a line between those towns in Pennsylvania. The line will pass through a rich farming district.

Extensive improvements have been planned by the American Railway Company, of Philadelphia, which purchased the line of the Logan Valley Electric Railway running from Wilkesbarre to Altoona.

The city of Mineral Wells, Tex., has granted to Mr. W. A. Mercer a twenty-five-year street railway franchise. Mr. Mercer has guaranteed to have an electric line in operation early next summer.

An ordinance giving the company the right to construct its electric railway tracks on the streets of Baltimore, Md., has been introduced into the city council by the Maryland Electric Railway Company.

The Coraopolis & McKee's Rocks Street Railway Company, in Coraopolis, Pa., has been chartered to build a line eight miles long between Coraopolis and McKee's Rocks. This company is capitalized at $48,000.

A number of gentlemen interested in the electric line from Zanesville, Ohio, to Wheeling and officials of the Newark, Michigan & Coshocton Line, have been in Newark, Ohio, consulting with Postmaster Ickes regarding the consolidation of the two lines.

Land along the survey of its proposed road from Waterbury to Southington is being purchased by the Connecticut Railway and Lighting Company in Connecticut. It is understood that the construction of the line will be undertaken early in the spring.

The president of the Keene Electric Railway has been authorized by the directors to petition the mayor and aldermen of Keene, N. H., for an extension of the line northerly from its present terminus to the Surry line and southerly from a point on Main street to the Swanzey line.

President Jerome Simmons, of the Atlanta Rapid Transit Company, of Atlanta, Ga., states that the company will build to Marietta, Stone Mountain, Brickhead and Manchester. These extensions will mean the construction of about thirty-three miles of street railway.

The committee of the city council of Milwaukee, Wis., has decided to report to the common council in favor of granting the Milwaukee Electric Railway and Light Company the additional franchises to lay tracks on certain streets of Milwaukee, which the company has asked for.

Authority to construct a line between Alexandria Bay on the St. Lawrence River and Redwood, N. Y., on the Rome, Watertown & Ogdensburg Railway has been granted by the state board of railroad commissioners to the St. Lawrence International Electric Railroad and Land Company.

The Westmoreland Railway Company, which operates a line between Irwin and Greensburg, Pa., has changed its name to the Pittsburgh, McKeesport & Greensburg Traction Company, and has been reorganized. A large amount of money will be expended in improvements and extensions by the new concern.

The Everett-Moore Syndicate has bought the Toledo & Maumee Valley Electric Railway, of Toledo, Ohio, for $680,000. In the purchase is included not only the Maumee Valley belt but also the Waterville extension of that line. The Maumee Valley line will hereafter be operated by the Toledo Railways and Light Company.

Franchises through Yorkville and St. Clair have been secured by the Pottsville & Suburban Street Railway Company, which is composed of a number of Philadelphia capitalists. The line will extend from Minersville through Yorkville to Port Carbon. It is expected that in time the lines will be connected with the lines now traversing the Mahonoy Valley.

The Pittsburg, McKeesport & Connellsville Railway has awarded contracts approximating $350,000 for the equipment of eight power stations to furnish current for the operation of the complete electric system between McKeesport and Masontown. The contracts call for the installation of the most modern machinery, which is to be built by the Westinghouse company.

Work is to be begun at once by the Pittsburgh, McKeesport & Connellsville Railway Company in connecting Pittsburgh and Connellsville by a street railway 150 miles long. Contracts have been awarded for eight of the fourteen power stations that will be supplied. They will be built by the Westinghouse Electric and Manufacturing Company and will cost about $400,000. They are to be similar to those built by the same concern for the New York elevated railway.

ELECTRICAL SECURITIES

There was some improvement in the stock market values during the week just closed. Negotiations are said to be in progress looking to an amicable settlement of the various questions at issue concerning the Northern Pacific Railroad situation. This has been a disturbing factor in Wall street for a long time. The copper situation is apparently as unsettled as before. Amalgamated copper is still weak, losing two points on Saturday, closing at 86⅜. The reserves of the associated banks are well above the averages of the past two years. It is not thought that the crops in the West and South will require as much currency shipped to these points as has been the case in former years. Money lenders, however, are apparently cautious. It is believed that considerable significance will be attached to the November elections and considerable interest is expressed in financial circles respecting the forthcoming message to Congress of President Roosevelt.

ELECTRICAL SECURITIES FOR WEEK ENDING OCTOBER 26.

New York:	Closing.
Brooklyn R. T.	60¾
Con. Gas	215
Gen. Elec	258
Man. El	119¼
Met. St. Ry	156
Kings Co. Elec	185
N. Y. & N. J. Tel. Co	165
Telep., Tel. & Cbl. Co	6

The committee on stock list has recommended that the $45,000,000 capital stock of the Brooklyn Rapid Transit Company be admitted to the regular list of the New York Stock Exchange.

The directors of the Westinghouse Electric and Manufacturing Company have declared the usual quarterly dividend of 1¾ per cent on the assenting stock. The dividend is payable November 15.

Boston, October 26:	Closing.
Am. Telep. & Tel	158
Erie Tel	25½
New Eng. Tel	134½
Mass. Elec. pf	92
Westing. Mfg. pf	75
Edison Elec	245

The Edison Electric Illuminating Company of Brockton, Mass., has declared a regular semi-annual dividend of 2½ per cent, payable November 1. Books close October 23 to November 1 inclusive.

It is announced from Detroit that Mr. Dudley E. Warner, president of the Grand Rapids National Bank, is at the head of a syndicate of Michigan capitalists which has secured a thirty-day option from the Executive Committee of the Erie Telephone and Telegraph Company to purchase all its holdings in the Michigan Telephone Company amounting to $30,000, a controlling interest.

Philadelphia, October 26:	Closing.
Elec. Co. of America	6⅝
Philadelphia Elec	5
Union Traction	27¼
United G. I. Co	113
Elec. Stor. Bat. c	65
Elec. Stor. Bat. pf	65

The following changes in the officers of the Electric Storage Battery Company have been made: Herbert Lloyd, formerly first vice-president, was made president, *vice* Geo. H. Day, resigned; George D. Widener, formerly second vice-president, was made first vice-president; John R. Williams, formerly third vice-president, was made second vice-president. The office of third vice-president has been temporarily abolished.

Chicago, October 26:	Closing.
Chicago Edison Light	162½
Chicago Telep	250
Un. Trac	17
Un. Trac. pf	54
Metropolitan El	90½

It is now considered that the financial affairs of the Central Union Telephone Company are placed in a satisfactory condition. This was brought about by each stockholder surrendering one-half—in all $3,000,000—and increasing again $3,000,000. As much of this increase as was not taken by the stockholders at par is to be taken, it is understood, by the American Telephone and Telegraph Company at par, notwithstanding the market price for the new stock is about $80. The last sale of the old stock was at $42, which is equal to $84 for the new. The new company now has over $2,000,000 new money for development and operates some 80,000 telephone stations in the Middle West.

PERSONAL MENTION

MR. SIDNEY H. SHORT, who is engaged with the English Electric Manufacturing Company, of Preston, Lancashire, England, is now in the United States.

MESSRS. E. M. PRINDLE, vice-president, and J. L. Putnam, engineer, of the Clark Automatic Telephone Switchboard Company, of Providence, R. I., were in New York during the past week.

MR. D. ADAMSON, who is connected with Joseph Adamson & Company, of Hyde, Cheshire, England, manufacturers of boilers and electrical traveling cranes, is now visiting the United States.

MR. W. KELSEY SCHOEPF, of Pittsburgh, Pa., has been made president of the Cincinnati Traction Company. Mr. Schoepf was formerly chairman of the executive committee of this company.

PROFESSORS MITSURU KUAHARA AND HANICHI MURAOKA, who occupy respectively the chairs of chemistry and physics in the Imperial University, of Kioto, Japan, and who have been spending a few weeks in this country, have sailed for Europe to continue their eastward trip around the world. They plan to reach Japan in February in time to resume their duties at the beginning of the second half year.

HERR I. K. SIEBER, who is a managing director of the Nürnberg-Fürther Strassenbahn Gesellschaft, and one of the most prominent members of the Verein Deutscher Kleinbahn and Strassenbahn Verwaltungen, is now in the United States on a tour of inspection of the principal electric railway systems of the country. He expects to visit Philadelphia, Washington, Pittsburgh, Chicago, Cleveland and other cities before he returns home.

HERR GUSTAVE AD. MEYER, of the firm of Allut, Nordt & Meyer, of Hamburg and Berlin, Germany, is at present in America. His concern is interested in the electrical and building trades and represents the German interests of the Standard Paint Company, of New York city, the Mayer & Englund Company, of Philadelphia, New York Belting and Packing Company, Limited, Frank S. DeRone Company, Limited, and the Standard Varnish Works. Mr. Meyer desires to correspond with American manufacturers who wish to have the sale of their products attended to in Europe, especially in Germany, Austro-Hungary and the northern countries. Mr. Meyer's address is care of the Standard Paint Company, 100 William street, New York.

AUTOMOBILE NOTES

Officers of the United States Army have made a test of an automobile to determine its efficiency for army purposes such as transportation of supplies, carrying sick and wounded, despatches, etc. A trip was made from Jersey City to Philadelphia. It is stated that the trip was enjoyable and free from mishaps. The machine will be put through additional tests before the board expresses an opinion regarding its use in the army.

The committee of the Automobile Club of America, composed of Messrs. William M. Power, Winthrop E. Scarritt and Harlan W. Whipple, has made its report upon the Endurance Contest from New York to Buffalo. The contest was discontinued at Rochester on account of the President's death. This report, which has been printed, contains many interesting incidents and facts of the run. It contains also a list of the contestants and the awards.

Four vehicles were entered by the American Bicycle Company in the first annual race meet of the Detroit Automobile Racing Association. The three races in which entries were made were five miles for steam carriages, one mile open to all vehicles weighing less than 1,500 pounds and the obstacle race. In the five-mile event the Toledo carriage secured second place, while the two vehicles entered in the one-mile open divided first and second honors between them. In the obstacle race the Toledo carriage scored 100 per cent, making the total Toledo winnings for the day one first and three seconds.

The following resolution has been offered by President Guggenheimer of the Municipal Council in New York, and adopted by that body: Whereas, The numerous casualties that have occurred upon the streets of this city recently, resulting in the maiming and death of passengers using the streets and avenues and roadways in the parks, and particularly the recent accident resulting in the death of one of the most faithful of our policemen, make the use of the streets absolutely unsafe for foot passengers, as well as those in vehicles drawn by horses, who are lawfully entitled to use the public highways, and be protected in such use; and, Whereas, Although the laws of the state as well as the ordinances of the city and rules, regulations, and ordinances of the Department of Parks, are intended to protect foot passengers and those in vehicles drawn by horses in their lawful use of the streets, avenues, and roadways of the parks, and if adequately enforced would afford such protection: Now, therefore, be it resolved that the Police Department and the Department of Parks be and the said departments hereby are requested to enforce with greater vigilance the laws, ordinances, rules and regulations relating to the use of the streets, avenues, and roadways of the parks by automobiles and all other motor vehicles to the end that foot passengers upon the streets, avenues, and roadways of the parks, as well as those in vehicles drawn by horses, may be protected and made secure from accident and death on the streets and avenues and roadways of the parks of this city.

EDUCATIONAL NEWS

THE NEW YORK TRADE SCHOOL, First avenue and Sixty-seventh and Sixty-eighth streets, New York, N. Y., is offering to journeymen electrical workers and steam engineers a course of practical lectures on subjects which are of interest to them. Circulars, giving the names of the lectures and the dates that they are to be given, will be supplied on application. The charge for these lectures is merely nominal.

INDUSTRIAL ITEMS

F. B. SAGE & BROTHER, 123 Liberty street, New York, N. Y., announce that they have taken the agency for the Hylo lamps in New York city and vicinity.

IT IS GIVEN OUT on the authority of the Electric Appliance Company, Chicago, that there are over 75,000 Adams-Bagnall lamps now in use in the United States and Canada.

THE D. & W. FUSE COMPANY, Providence, R. I., has just perfected an entrance cutout for use on the smaller electric lighting installations, in two types, for two and three-wire systems.

THE SPRAGUE ELECTRIC COMPANY, of New York, has received an order calling for a number of motors, ceiling fans, etc., from the contracting firm of Bagnall & Hilles, of Japan, the Philippine Islands and Straits Settlement.

THE GENERAL ELECTRIC COMPANY, of Schenectady, N. Y., is making shipments of electrical machinery to the American electrical engineering and contracting firm of Bagnall & Hilles, Kobe, Japan, for installation in the lighting plants there.

THE CENTRAL ELECTRIC COMPANY, of Chicago, Ill., wishes to call attention to its "Ideal" dry battery, which is said to be a fine battery at a moderate price. The battery has now stood the test of practical work, and it is expected that the demand will increase rapidly.

THE L. C. SHARP MACHINE WORKS, of Omaha, Neb., is issuing a folder describing Sharp's commutator clamp, which is made in four sizes; also giving an abstract of Mr. Sharp's book on "Construction and Repair of Commutators" which should be of interest to practical electrical men.

THE NEW YORK & OHIO COMPANY, of Warren, Ohio, is issuing a very attractive booklet for the purpose of describing its incandescent lamps, sunshine globes and transformers. This company has a large factory and one which is calculated to facilitate the manufacture and prompt delivery of orders.

MR. GEORGE H. DANIELS, general passenger agent of the New York Central & Hudson River Railroad, is issuing number 11 of the Four-Track Series, entitled "Race with the Australian London Mail." An idea of the two routes for mail between Sydney, Australia, and London is given, and the one *via* San Francisco and the United States is very elaborately and interestingly described.

D. L. GILLESPIE & COMPANY, Pittsburgh, Pa., are preparing to ship 16 car loads of wooden doors. These wooden doors are intended to be used in the Manchester plant of the British Westinghouse Electric and Manufacturing Company, Limited. The entire contract, valued at some $50,000 for the lumber and woodwork used in the construction of the English works, has been secured by this company.

THE COMMITTEE ON STANDARDIZING flanges for heavy pipe, fittings and valves, which was chosen at a meeting of representatives of the leading valve and fitting concerns in New York, has completed its labors and obtained final decisions from the manufacturers interested. The summary of decisions reached has been published and should be of interest to all engaged in this line of work.

THE ELECTRIC MOTOR AND EQUIPMENT COMPANY, of Newark, N. J., is issuing a very neat little book describing its Brewster universal sign receptacles. This system of units is especially adapted for use in decorative or spectacular electric lighting or sign work of any description. These electric signs and decorations are said to be thoroughly weather-proof. From this system of units anything in the shape of electric signs or electric decorations may be quickly installed.

THE NEW BRITAIN MACHINE COMPANY, of New Britain, Ct., has prepared a very neat booklet for distribution. In this booklet its line of machine shop furniture in iron and steel is described. This line embraces fifteen different styles of tool racks in two sizes, four sizes of lathe pans and shop shelving, and also a new lathe rack and oil feeder, which are practical articles and are said to be meeting with a warm welcome from machinists.

THE HOLOPHANE GLASS COMPANY, of New York, received a gold medal at the Pan-American Exposition. This company's globes are manufactured for all kinds of light, gas or electric, and have met with much popular favor. A new and artistically gotten-up catalogue will be sent on application to this company's office, 15 West Thirty-second street, New York city. One of its newest designs is the Pagoda prismatic reflector, made of the finest clear crystal glass.

THE STERLING-MEAKER COMPANY, of New York city, is in receipt of a number of very satisfactory orders for export. Among these are 150 pairs of "Sterling" safety brakes for an electric railway in Lisbon, Portugal. This is a new trolley line that has just been recently installed. In addition, the Sterling-Meaker Company is sending to a foreign house on orders for Austria, Germany and Russia, some 3,500 of the well-known "Sterling" registers for use on the street car lines of those countries.

THE FALCON ELECTRIC MANUFACTURING COMPANY, of New York, is distributing a neat booklet in which it calls attention to its specialties. Among them are all-copper straight fuse panel boards, all-copper bridged fuse panel boards, all-copper switchboard panels, all-copper fuse blocks, lugs for the Falcon knife switches and many other articles of ordinary use to electricians. This company carries a very large stock, which enables it to execute almost any order within a comparatively short time.

THE HOUSE OF ROSSITER, MACGOVERN & COMPANY, 141 Broadway, New York, is sending out its October catalogue of special machinery that is on hand for prompt delivery. It includes a large class of representative apparatus such as railway generators, arc generators, rotary converters, trolley cars, arc lamps and steam engines. This company, which has its headquarters at 141 Broadway, New York, is quite busy at its factories in Brooklyn and Jersey City. A catalogue of special apparatus of this kind will be forwarded on request.

THE McCAY ENGINEERING COMPANY, of Baltimore, Md., is distributing a very neat booklet describing its electric heating appliances and switchboards. In this pamphlet electric heating is described pretty fully and the approximate cost of current construction attachments, etc., is given. This company also manufactures domestic, laundry and tailors' electric irons, and it is also prepared to make up estimates and submit designs on switchboards of any capacity or design. It guarantees to repair free of charge all its electric heaters, provided that they are used on voltages for which they were designed, for a period of one year.

THE FEDERAL ELECTRIC COMPANY, of New York, N. Y., has received a request from a foreign government for catalogues, circulars and descriptive matter treating all classes of electrical material manufactured in the United States. This company purposes securing as many catalogues as possible and forwarding them to its correspondents. Manufacturers desirous of being represented are requested to send catalogues in triplicate to the export department of the company and to mark on the wrapper or envelope containing the catalogues or circular matter the word "foreign," in order that it may be known for what purpose the catalogue is sent.

NEW INCORPORATIONS

DOVER, DEL.—Electric Fountain Company of America. $1,000,000.

JACKSON, OHIO—The Jackson Center Telephone Company. $6,000.

AKRON, OHIO—Barberton, Akron & Eastern Railway Company. $35,000.

SHERMAN, TEX.—Indianapolis Telephone and Telegraph Company. $200,000.

CHICAGO, ILL.—Central Union Telephone Company. Increase of capital stock to $3,481,500.

DAYTON, OHIO—The Dayton, Covington & Piqua Traction Company. Increase of stock from $50,000 to $1,150,000.

NEW YORK, N. Y.—The Hubbell-Grier Electric Company. $25,000. Directors: Harvey Hubbell, E. R. Grier and others.

MOUNTAIN GROVE, MO.—Wright County Telephone Company. $2,500. Incorporators: J. H. Medley, J. F. McComb and others.

ST. LOUIS, MO.—Hill Electrical Manufacturing Company. $25,000. Paid. Stockholders: Harry M. Hill, W. P. Foster and others.

NEW YORK, N. Y.—The Empire Motor Company. $250,000. Directors: B. S. Teale, of Oneida; G. B. Gurley, of New York, and others.

JACKSON, MICH.—The Jackson & Albion Electric Railroad Company. $350,000. To build an electric road from Jackson to Albion.

LITTLE ROCK, ARK.—Kitson Light Company. $40,000, of which $5,000 has been subscribed. Incorporators: C. A. Pratt, J. M. Stewart and others.

NEWARK, OHIO—The Columbus, Newark, Zanesville & Wheeling Electric Railway Company. $50,000. Incorporators: L. C. Taylor, J. S. Black and others.

PAXTON, ILL.—Central Telephone and Telegraph Company. $30,000. To operate telephone and telegraph lines. Incorporators: C. H. Langford, W. B. Henderson and others.

FRESNO, CAL.—Fresno City Railway Company. $500,000, divided into 5,000 shares, and $4,300 has been already paid in. Stockholders: S. N. Griffith, W. T. Porter and others.

DAYTON, OHIO—The Dayton, Covington & Piqua Traction Company has filed an amendment to its articles of incorporation, increasing its capital stock from $5,000 to $1,150,000.

QUINCY, ILL.—Quincy & Southeastern Electric Railway Company. $5,000. To operate electric railways, power and light plants. Incorporators: Robert W. Gardner, George Wells and others.

OTTAWA, ILL.—Illinois River Railway, Light and Power Company. $2,000,000. To operate an electric railway, light, heat and power plants. Incorporators: William H. Duval and Edward J. Hamel.

BEAUMONT, MO.—Beaumont Northwestern Telephone Company. $10,000. To build and operate telephone lines in Jefferson and other counties of eastern Texas. Incorporators: J. M. Smith, W. S. Bruce and others.

SHERMAN, TEX.—Indianapola Telephone and Telegraph Company. $200,000. To construct and operate telephone lines and exchanges throughout the state. Incorporators: J. B. Earl, of Waco; W. B. Richie, of Lima, Ohio, and others.

List of Electrical Patents Issued Last Week

[Specially reported for this journal by E. S. Duvall, solicitor of patents, Loan and Trust Building, Washington, D. C. Copies of any patent may be secured for 10 cents each.]

ISSUED OCTOBER 22, 1901.

684,785 Electric arc lamp; J. Bouillet, Levallois-Perret, France.

684,791 Electric resistance; E. R. Carichoff, East Orange, N. J.—A resistance for car use, comprising a support, an insulating block, a grid comprising a looped strip of resistance material, said grid being suspended and depending from said insulating block, and means for securing said grid to said block.

684,828 Spark-gap regulator; T. B. Kinraide, Boston, Mass.—A system including a main-line conductor, a condenser, spark-gap and translating device arranged in series, means actuated by the current of said main-line conductor for automatically maintaining said spark-gap set for a given discharge.

684,880 Incandescent lamp base; A. Swan, New York, N. Y.

684,881 Railway signal; H. B. Taylor, Newark, N. J.

(Continued on page 38.)

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American and Foreign Patents Secured Promptly. Moderate Fees.
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Opinions on Scope or Validity of Patents.
Expert Examinations of Patent Office Records.
Abstracts of File Wrappers of Applications before Patent.
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PATENTS.

(*Continued from page 37.*)

684,893 Electric feed regulator for steam boilers; M. L. Whitfield, Memphis, Tenn.

684,906 Electrical reciprocating apparatus; J. Brown, Belfast, Ireland.

684,909 Insulating bushing; J. A. Cole, Boston, Mass.

684,950 Electric mine locomotive; C. Robinson, Columbus, Ohio.

684,952 Street railway signaling system; J. J. Ruddick, Newton, Mass.

684,963 Telephone instrument; W. W. Washburn, Chicago, Ill.

684,977 Electric belt; A. Chrystal, Marshall, Mich.

685,008 Electric signaling system; J. J. Ruddick, Newton, Mass.—A signaling system for railways, comprising a track, vehicles on said track, a normally open electric circuit including an indicator on one of the vehicles, means to close the circuit, said means including an oscillatory magnetic needle adapted to be attracted by another vehicle.

685,012 Means for increasing the intensity of electrical oscillations; N. Tesla, New York, N. Y.—A circuit adapted to vibrate freely, and means for artificially cooling the same to a low temperature.

685,024 Party-line telephone system; W. W. Dean, Chicago, Ill.

685,039 Speed controller for engines; T. M. Foot, Brooklyn, N. Y.

(*Concluded on page 40.*)

WANTED—SEVERAL PERSONS of character and good reputation in each state (one in this county required) to represent and advertise old established wealthy business house of solid financial standing. Salary $18.00 weekly with expenses additional, all payable in cash each Wednesday direct from head offices. Horse and carriage furnished, when necessary. References. Enclose self-addressed stamped envelope. Manager, 816 Caxton Building, Chicago.

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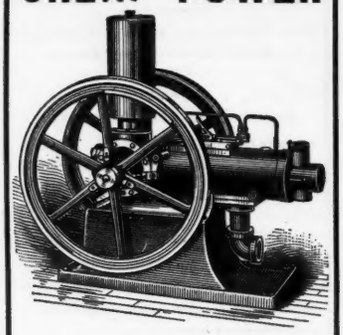
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1—125-light 10-ampere Brush
1—165-light Brush, with oil regulator
2—LD 12-50-light 1,200-candle-power T.-H. M2, M12 T.-H. and others

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2—120 K. W., G. E., single-phase, latest type, 15,000 alt
2—Fort Wayne, 300 K. W., and 120 cycles
1—100 K. W., Westinghouse, single-phase, 16,000 alt., compound wound, self-oiling
1—National, 120 K. W., 2,000 volts
1—300 K. W., Stanley, two-phase, 16,000 alt., 400 R. P. M.

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2—15 x 15 Armington & Sims
1—12 x 13 Armington & Sims
1—13 x 12 New York Safety
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100 to 1,000 horse-power CORLISS ENGINES of almost every size

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1—90 K. W., T.-H., M. P.
1—D62 T.-H.
1—100 K. W. Edison bipolar

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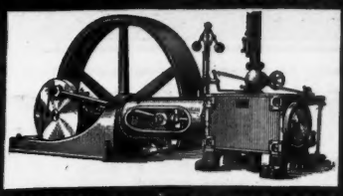

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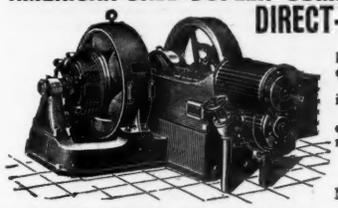

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2—D62 Thomson-Houston.
2—60-kw Edison.

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1—50-kw Western Electric.
2—60-kw Edison.
2—45-kw Edison.
3—30 kw Edison.
5—25-kw Edison.
1—20-kw Edison.
1—50-kw Siemens & Halske.
1—30-kw Eddy, M.P.
1—25-kw M.P.-6 Excelsior.
1—22½-kw Westinghouse, M.P.
1—16-kw Lundell.
1—13½-kw American Ball (new).
1—12½-kw Kester, M.P.
1—15-hp Excelsior.
1—15-hp Mather.
1—10-hp M.P. Excelsior.
1—10-hp bipolar Excelsior.
3—D3 T.-H. Bipolar.

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1—25-hp Keystone, M. P.
1—25-hp Eddy, M. P.
1—12-hp Edison
1—12-hp Jenney.
1—10-hp Mather.
1—9-hp Jenney.
1—2 hp C & C.

BELTED DYNAMOS AND MOTORS 220 VOLTS

1—D62 Thomson-Houston.
1—25-hp Excelsior.
1—10-hp Eddy.
1—10-hp Thomson-Houston.
1—10-hp Lundell.
1—8-hp Excelsior.
1—7½-hp Lundell.
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1—240-kw Westinghouse, 110 volts, 16,000 alternations, single-phase.
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2—A120 General Electric, single-phase, 1000 volts, 16,000 alternations.
1—120-kw Westinghouse, single-phase, 2000 volts, 16,000 alternations.
1—100-kw Fort Wayne, 2200 volts, 16,000 alternations.
1—75-kw Stanley, 2000-1000 volts, two-phase, 16,000 alternations.
2—60-kw General Electric, single-phase, 1100 volts, 16,000 alternations.
2—60-kw Westinghouse, single-phase, 16,000 alternations, 1100 volts.
1—45-kw Westinghouse, 2200 volts, 16,000 alternations.
1—45-kw Westinghouse, 1100 volts, 16,000 alternations.
2—A-35 General Electric, single-phase, 16,000 alternations, 1050 volts.
2—A-30 General Electric, single-phase, 16,000 alternations, 1050 volts.

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PATENTS.

(Concluded from page 38.)

685,042 Electric furnace; W. T. Gibbs, Buckingham, Canada.

685,043 Electric method of fusion; W. T. Gibbs, Buckingham, Canada.

685,072 Arrangement for controlling electric elevators; E. A. Wahlstrom, Cannstadt, Germany—An auxiliary motor, switches arranged in each floor in number corresponding to the number of floors attended, each of the switches adapted to be actuated separately, and means for preventing the actuation of the other switches.

685,101 Electric battery; P. Chapuy, Vincennes, France—A plurality of porous non-conducting blocks, electrodes embedded in said blocks and consisting of rows of separate parts, and an electrode between said blocks.

685,110 Electrically illuminated display fountain; F. B. Crouch, New York, N. Y.

685,155 Synchronism-indicator; P. M. Lincoln, Niagara Falls, N. Y.—Two relatively movable elements, a plurality of sources of one electromotive force, and means associated with the other element for producing two-phase displaced fields, subject to variations on the phase of another electro motive force.

685,156 Governor mechanism; P. H. Lincoln, Niagara Falls, N. Y.

685,239 Apparatus for recording and repeating telephonic speech; H. A. Rhodes, Denver, Col.

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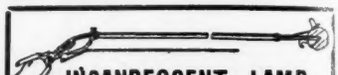

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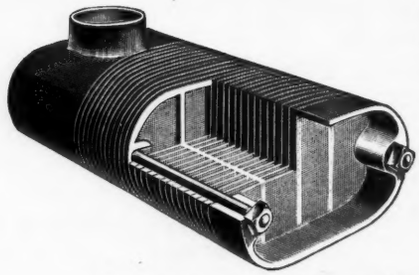

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